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The roles of aggressive and affiliative behaviors in resource control: A behavioral ecological perspective[☆]

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Abstract

Extant literature in developmental psychology has documented the co-occurrence of aggressive and affiliative behaviors with various measures of social dominance. While these findings have been taken as evidence for the functional value of aggression, they have not been integrated into a more general frame accounting for contextual variation. In this paper the literature on aggression, agonism, affiliation, and social dominance is reviewed in light of behavioral ecological theory suggesting that different forms of competition (scramble and contest) determine, respectively, the use of affiliative and aggressive strategies. Results generally support the hypotheses advanced by this theory. In order to further integrate these findings suggestions for the study sequences of behavior, where reconciliations follow aggression, are made.

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In developmental psychology (e.g., Coie & Dodge, 1998) and ethology (McGrew, 1972) aggression and cooperative behavior have traditionally been placed at opposite ends of a continuum of social behavior. Aggression is typically considered to have “dispersive” effects on social groupings, such that after an aggressive act (e.g., a kick or punch) targets

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typically leave the scene, often to escape injury (e.g., Hartup, Laursen, Stewart, & Eastenson, 1988; McGrew, 1972). Indeed, dispersal is sometimes used as a criterion for differentiating aggressive from non-aggressive behavior (e.g., Humphreys & Smith, 1987; Pellegrini, 1988; Savin-Williams, 1987; Smith & Connolly, 1972). Further, and especially in developmental psychology, aggression has also been considered to be a behavior used by individuals with deficient social information processing skills (e.g., Dodge, 1986). By contrast, cooperation and other forms of affiliative behavior relate to social proximity. Cooperation binds individuals in groups and is considered a hallmark of social competence (e.g., Dodge, 1986; Waters & Sroufe, 1983).

During the past 25 years or so, researchers in the areas of peer relations (e.g., Hawley, Little, & Rodkin, 2007; Ostrov & Keating, 2004; Ostrov, Pilat, & Crick, 2006; Rodkin, Farmer, Pearl, & Van Acker, 2000) and evolutionary-oriented psychology (e.g., Bjorklund & Pellegrini, 2000; Cairns, Cairns, Neckerman, Gest, & Garipey, 1988; Hawley, 1999, 2006; Vaughn & Santos, 2007; Vaughn, Vollenweider, Bost, Azria-Evans, & Snider, 2003) have begun to reformulate relations between aggression and cooperation and social competence. Perhaps most importantly, these researchers have documented the co-occurrence of aggression, other agonistic behaviors, and cooperation and have begun to consider possible functions of aggression. Correspondingly, some evolutionary-oriented researchers suggest that the ubiquity of aggression across most invertebrate and vertebrate species (Archer, 1988) indicates that it has been naturally selected and thus serves some function, possibly to access resources or for defense.

From these positions, it has been argued that the co-occurrence of some forms of aggression and affiliative behaviors can be explained in terms of social dominance relationships (e.g., de Waal, 1982; Hartup, 1983; Hawley, 2003; Hawley & Little, 1999; Pellegrini & Bartini, 2001; Pellegrini, Long, Roseth, Bohn, & Van Ryzin, 2007; Pellegrini, Roseth, et al., 2007; Roseth, Pellegrini, Bohn, Van Ryzin, & Vance, 2007). Specifically, aggression may be used in the early phases of group formation and enables individuals to recognize their relative status in that group, thus attenuating future aggression and increasing group cohesion, not dispersal.

In this paper, behavioral ecological theory is used to explain the ways in which aggression and affiliation relate to social dominance. In keeping the centrality of resource control in social dominance (e.g., Charlesworth, 1988; Dunbar, 1988; Hinde, 1978), I frame the social behaviors used to access resources in terms of different types of competition (i.e., contests and scrambles). From this position, behaviors and strategies used by individuals to access and maintain resources will vary according to the costs and benefits of using different sorts of competitions. By “strategy” I mean any behavior (e.g., aggression, reconciliation) or morphological feature (e.g., physical size, physical attractiveness) that is optimized in order to access resources (Stephens & Krebs, 1986), thus, an optimal strategy does not have to be made at a conscious level.

One form of competition, *contests*, by definition, have winners and losers where the winners can take all of the resources. This sort of competition should involve aggression and thus is very costly (e.g., possibility of injury or death). In *scramble* competition, on the other hand, all individuals access resources, thus aggression is not typically used and is less costly than contests. Organizationally, I first discuss social dominance. As part of this discussion, I consider the function of aggression and ways in which individuals assess costs in social dominance bouts. Second, I discuss behaviors associated with social dominance. Third, I proffer an explanation for the co-occurrence of aggressive and affiliative behaviors

in socially dominant children and youth. I argue that uses of these behaviors vary according to the nature of the competition (i.e., contest and scramble) and the use of post-aggression reconciliations. Evidence relevant to these predictions is reviewed.

Social dominance

Early work on social dominance by ethologists (e.g., Francis, 1988; Nicholson, 1954) and child developmentalists (e.g., McGrew, 1972; Pellegrini, Horvat, & Huberty, 1998; ~~Sluckin & Smith, 1977~~) stressed the role of aggression. For example, some researchers equated dominance with sociometrically nominated “toughness” (e.g., Sluckin & Smith, 1977) while others included the frequency of observed aggression as a component of social dominance (e.g., Pettit, Baksi, Dodge, & Cole, 1990). In such cases, toughness and aggression were typically used to define social dominance without reference to resource control. As Vaughn and Santos (2007), among many others (e.g., Bernstein, 1981; Francis, 1988), have pointed out, aggression and social dominance are different constructs.

More in line with ethological studies and the centrality of resource control (Crook, 1970, 1989), social dominance has been defined in terms of dyadic contests and group structure (Hinde, 1976). Dyadic contests, and the resulting social relationships, are defined in terms of agonism, or winners and losers in resource contests. From the outcomes of these dyadic encounters, group-level dominance hierarchies are constructed (e.g., La Freniere & Sroufe, 1987; Savin-Williams, 1987; Sluckin & Smith, 1977; Strayer, 1980; Vaughn & Waters, 1981). For example, two children are observed in their preschool, each trying to get on one swing. Child A pushes B and A gains access to the swing. In this instance A would be coded the winner and B the loser. These sorts of dyadic encounters can be used to determine *dominance relationships*. In cases where the frequency of individuals' aggressive behaviors alone or initiated attempts alone, are used as a metric, without reference to the efficacy of these behaviors in controlling resources, aggression, not social dominance, is being documented (Vaughn & Santos, 2007).

Further, it is important to keep social dominance *relationships* distinct from social dominance *rank* as they represent different levels of abstraction (~~Hinde, 1976~~), where the former reflects a dyadic relationship and the other reflects an individual's place in a larger group (Hinde, 1976). The total number of dyadic contest wins entered into a dominance matrix is typically used to determine *rank*, or an individual's status in relation to the larger group. For example, A defeats B and B defeats C. The hierarchy would be $A > B > C$ and assumed to be transitive. Thus, B is unlikely to challenge A and C unlikely to challenge B, each knowing that they would likely be defeated. Based on these comparisons, individuals are rank-ordered in the group.

~~Importantly, different~~, but complementary, behavioral strategies may be used to achieve dominance relationships and dominance rank. For example, in dyadic contests for resources, aggression might prove effective while aggression alone is probably not sufficient to maintain high rank (Blurton Jones, 1967; de Waal, 1982; Hartup, 1983; Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007; Rowe, Maughan, Worthman, Costello, & Angold, 2004). During childhood, for example, affiliation may be observed after aggression to reconcile defeated peers and bring them into a coalition with the leader (de Waal, 1982; Roseth, 2006; Roseth et al., 2007; Verbeek & de Waal, 2001).

Though individuals' ranks in dominance hierarchies have been used in studies of children's (e.g., La Freniere & Charlesworth, 1983a; Sluckin & Smith, 1977; Strayer, 1980;

Vaughn & Waters, 1981) and adolescents' (Savin-Williams, 1976, 1987) social dominance in naturalistic settings, they are of questionable validity ~~in most cases~~ because these rank scores are based on the typically untested assumption that all individuals in a group encounter each other in at least one contest (Archer, 1992; exceptions include Savin-Williams, 1987). When this assumption was tested in two groups of preschool children observed ~~in their classrooms~~, it was not supported (Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007; Roseth, 2006). Indeed, in these studies, children did not interact socially with all of their classmates nor did they encounter each other in dyadic contests. Rather, children strategically chose the targets of their interaction and aggression, consistent with findings in the bully-victim literature in both childhood and adolescence (e.g., Pellegrini et al., 1999; Pellegrini & Long, 2003; Perry et al., 1988) as well as findings in the adult aggression literature (Archer, 2001, 2004). In light of these findings and the primacy of resource control in the social dominance literature (e.g., Charlesworth, 1988; Dunbar, 1988), the ratio of total number of wins in direct contests/the total number of resource contests has been recommended as an index of social dominance, rather than place in a group hierarchy, when children are observed in their natural ecologies (Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007).

Correspondingly, and following sexual selection theory (Darwin, 1871), individuals typically target same-sex peers in resource contests. The results of these intra-sexual contests prioritize individuals' access to resources in their same-sex groups. For example, observed aggressive bouts between same-sex preschoolers are greater than those between opposite-sex peers in classroom settings (McGrew, 1972; Ostrov, 2004; Ostrov et al., 2006; Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007) and in home settings (Stauffer & DeHart, 2005). Similar patterns of intra-sexual aggression have also been observed during adolescence (Pellegrini & Long, 2003) and adulthood (Archer, 2001).

Following from a sexual selection position, same-sex peers compete with *each other* for status and control of resources, where the dominant members have preferred resource control, relative to less dominant individuals. More specifically, both females and males compete intra-sexually but using different strategies. Males' competition should be more direct and involve physical and aggressive strategies (Campbell, 1999; Pellegrini & Long, 2003; Savin-Williams, 1987) while females' should be less direct and involve using physical attractiveness, social ostracism, and ridicule (Campbell, 1999; Savin-Williams, 1987). From these competitions, theory predicts, females choose dominant males (Campbell, 1999; Darwin, 1871).

Empirically, there is only equivocal support for the existence of sex differences in behaviors used in social dominance encounters. While males, ~~more than~~ females, are more competitive and physically aggressive, (Pellegrini & Archer, 2005) and females use less direct forms of aggression, especially in late childhood and adolescence (e.g., Campbell, 1999; Savin-Williams, 1987), sex differences in the context of using these strategies to access resources has not, generally, been observed during early childhood, but becomes more apparent in adolescence (e.g., Savin-Williams, 1987). This may be due to the fact that many of the preschool samples are university-affiliated and exhibit relatively low on rates of physical aggression.

The case is different during adolescence. Savin-Williams' (1987) study of adolescent males and females at summer camps showed that girls', relative to boys', agonism was less direct. He also noted that dominant girls tended to be tolerant and complimentary of their peers, perhaps as a way in which to build a strong peer network. Consistent with this idea, he found that females' dominance was ordered in a less hierarchic fashion, relative to males'. Girls shared places in a dominance order, often with their friends. These findings

are consistent with the idea of the use of alliances in social dominance (e.g., de Waal, 1982; Roseth, 2006).

Aggression as functional in the context of social dominance

Judgments about the “function” of aggression, or any other behavior or strategy, are typically made by biologists (e.g., Krebs & Davies, 1993; Wilson, 1975), evolutionary-oriented anthropologists (Borgerhoff Mulder, Richerson, Thornhill, & Volland, 1997), and evolutionary-oriented psychologists (e.g., Archer, 1988, 1992; Pellegrini et al., 1998) by evaluating the ratio of costs associated with the behavior or strategy (such as injury and caloric and time expenditure) to benefits (such as resource control). From this logic, individuals using strategies where benefits exceed costs will be favored by natural selection, relative to those using strategies where costs exceed benefits.

Function, from an evolutionary perspective, has distal and proximal dimensions (Hinde, 1980). Distal functioning refers to “ultimate” function, or the degree to which any behavior or strategy results in fitness, or reproduction and survival of offspring. More proximally, function relates to those consequences of a behavior or strategy that are immediately beneficial, such as accessing food or self-defense. The construct of social dominance, especially when embedded in behavioral ecological theory, as will be explicated below, can be used to reconcile ways in which aggression is used to serve both proximal and distal functions.

Social dominance serves a distal function because it relates to mate access and fitness in a variety of species, including humans (e.g., Buss, 1989; Noorwijk & van Schaik, 2004; Pusey, Williams, & Goodall, 1997). While fitness is obviously not an immediate concern for preschool children, social dominance is relevant when we consider social dominance in terms of “competitiveness,” or competing for resources, as well as physical conditioning. Specifically, and consistent with life history theory, an optimal strategy for preschoolers involves relatively high levels of competitiveness which, in turn, should lead to increased physical activity, physical size, and fitness (Alexander, Hoogland, Howard, Noonan, & Sherman, 1979; Lessells, 1991; Pellegrini, 2004). As will be discussed below, preschoolers’ physical size has been linked theoretically and empirically, ~~in some studies,~~ to social dominance (Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007; Tremblay et al., 1993; ~~for support, see Hawley & Little, 1999~~). ~~Further, socially dominant preschoolers use aggression to access toys (Smith & Connolly, 1980) and adolescent males use aggression to attract females (Pellegrini & Bartini, 2001; Pellegrini & Long, 2007). Thus, social dominance encounters in preschool school and adolescence may have immediate beneficial consequences, such as physical fitness and self-efficacy, and these, in turn, should relate to ultimate function.~~ Engaging in the physically vigorous behaviors associated with dominance bouts in childhood, for example, promote immediate cardiovascular, muscular, and skeletal benefits (Pellegrini and Smith, 1998). During adolescence, winning social dominance bouts is related to heterosexual contact (Pellegrini & Long, 2007) and should relate to future mating opportunities.^λ

Assessing costs in social dominance bouts

An important assumption in this research is that there is a relation between the choice of specific behaviors and strategies and the value resources. From this position, individuals

assess the relative costs and benefits associated with contesting specific resources. However, research into individuals' ability to assess costs and benefits associated with using certain strategies has, generally, been indirect (though see Hawley & Little, 1999). Inferences about assessing costs and benefits associated with using aggression to access resources can be derived indirectly from observed rates of aggression in newly formed peer groups. The assumption is that decrements in aggression in newly formed groups are a result of recognizing the costs and benefits of using aggression. Specifically and consistent with many variants of social dominance theory (e.g., Bernstein, 1981; Hawley & Little, 1999; Hinde, 1980), rates of aggression should be high in new groups as individuals are assessing each others' resource-holding power (e.g., physical strength and number of allies). With time and as individuals recognize their resource-holding power and that of their peers, rates of aggression should decrease.

However, there is an alternative explanation for decrements of aggression with time: Children's rates of aggression also decline with as a function of age (Coie & Dodge, 1998). To account for this alternative hypothesis, Pellegrini and Long (2002) observed a group of youngsters as they moved from primary to middle school. This transition is an ideal one to study given the simultaneous disruption in peer networks and increased importance of peer status (e.g., Wigfield, Byrnes, & Eccles, 2006). Consistent with the social dominance hypothesis, Pellegrini and Long (2002) found that rates of self-reported aggression increased with the transition from primary to middle school and then declined across the next two years of middle school. These observations suggest that when new groups are being formed, levels of dyadic aggression increase as individuals sort out their status, then, with time, decrease as individuals recognize dominance relationships. Subordinates seemingly recognize that costs of challenging dominant individuals outweigh benefits. Similarly, dominant individuals may not be aggressive because they recognize that they have more to lose than gain from such a strategy.

While decrements in aggression across time have been documented in two samples of preschoolers across a school year (Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007; Roseth et al., 2007) and one sample of adolescents across three years (Pellegrini & Long, 2002), it is not direct evidence that individuals assess costs and benefits of using aggression in dominance contests. Concurrent support for the preschool findings also comes from Hawley and Little (1999) who found that familiarity among children moderated the relation between social dominance and directing behavior.

That individuals actually recognize costs and benefits associated with using aggression in peer groups is supported on other levels, however. Behavioral ecological and sociobiological theories (e.g., Dawkins & Krebs, 1978; Parker, 1974) posit that in contests, individuals assess the resource-holding power of each other and the value of the resource being contested (e.g., scarce or abundant) before deciding whether to use aggression or not. To minimize costs, individuals often "display" their prowess (e.g., puffing up their chests or standing tall) before using aggression. In this way they can evaluate their opponent's resource-holding power in relation to their own at the start of a conflict and thereby avoid a costly aggressive encounter. The animal world is replete with these sorts of displays. The vocalizations of red deer, for example, correspond to their ability to win fights (Clutton-Brock & Albon, 1979). Consistent with sexual selection theory, physical size, too, corresponds with ability to win competitive encounters in many non-human species (e.g., Bernstein, 1981; Pusey & Packer, 1997): Bigger usually means tougher, stronger, and more likely to win an encounter. This may also be the case with preschoolers, where physical

size correlates positively and significantly with winning aggressive encounters and social dominance (Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007; Roseth, 2006; Tremblay et al., 1993). In a related study, Hawley and Little (1999), found that a macro-level variable labeled developmental maturity (which included physical size, mental age and chronological age) predicted social dominance, leading them to conclude that “dominant children tended to be the oldest, largest, and most cognitively advanced” (p. 197). In short, research suggests that preschoolers may read display signals, such as size or numbers of allies present, and make a decision of the strategy they will employ. If they evaluate their opponents’ position as weaker than theirs (e.g., opponents may be physically slighter than they are) then they might use aggression to access the resource.

The relations between physical stature and social dominance become more equivocal during adolescence. In a summer camp-based study of adolescent males and females, Savin-Williams (1987) found that physical size, alone was not significantly correlated with social dominance for either males (.37) or females (.28). However, other measures of physical prowess were related to dominance. Specifically, pubertal maturation ($r = .55, p < .1$) and athletic ability ($r = .59, p < .05$) were correlated with social dominance for females, and for males, .59 ($p < .05$) and .59 ($p < .05$). Similarly, physical fitness (measured only for males) correlated .66 ($p < .05$) with social dominance. The empirical support for relations between social dominance and physical size needs to be addressed in future research, given its theoretical importance but relative paucity of data relative to this issue.

Further, researchers should also attend to the degree to which sex moderates the relation between physical size and social dominance. Specifically, sexual selection theory and behavioral ecological theory posit that physical size should be more important to males’ relative to females’, resource control. From this theory, males’ physical size is an important aspect of their resource-holding power, which should relate to their winning direct contests for resources. One would also expect the relative importance of physical size per se in dominance relationships to vary with age. With age, and less physical size variability (Savin-Williams, 1987), size should be less important. It may be the case that in adulthood, physical size alone is a less adequate approximation of resource-holding power. Instead, more specific aspects of one’s body, such as physical threat displays (Savin-Williams, 1987) and physical strength (Sell, 2005), are better indicators of “resource-holding power” than size alone.

In a direct test of the hypothesis that contestants assess the resource-holding power of opponents before using aggression and recognize costs and benefits of using aggression, Archer and Benson (in press) experimentally manipulated the resource-holding power of male and female adults (e.g., number of allies present, reputation for aggression), as well as level of provocation in individuals’ use of aggression. Resource-holding power is a construct derived from behavioral ecology. The resources that individuals brings to a conflict, such as physical size, reputation for winning, and number of allies present, should be evaluated by contestants in various phases of a contest (e.g., Parker, 1974). Consistent with the hypothesis, results (in three separate experiments) showed that the likelihood of using aggression increased as opponents’ resource-holding power decreased. For example, an individual would be more likely to use aggression if their hypothetical opponent had no, rather than many, allies present. These findings, in concert with the preschool and adolescent results presented above, are evidence that individuals recognize the costs associated with using aggression; they are not likely to use it in cases where costs outweigh benefits. Thus, the use of aggressive and affiliative strategies to control resources should vary according to different cost:benefit ratios associated with different sorts of competition.

The co-occurrence of aggression and affiliation in resource control

The co-occurrence of aggressive and affiliative behaviors in social dominance and resource control encounters has been recognized by students of children's development, at least since [Blurton Jones \(1967\)](#). More recently, numerous scholars have also observed that social dominance is not simply a matter of toughness or aggression but that individuals use aggressive and affiliative strategically to control resources in the context of social dominance ([Hawley, 1999, 2002](#); [La Freniere & Charlesworth, 1983a, 1983b](#); [Pellegrini & Bartini, 2001](#); [Rowe et al., 2004](#); [Savin-Williams, 1987](#); [Vaughn et al., 2003](#)). Further, some researchers have also suggested that socially dominant individuals tend to be socially competent ([Vaughn et al., 2003](#); [Vaughn & Santos, 2007](#)) and this requires using a sophisticated balance between aversive and more affiliative strategies, like cooperation, reconciliation, and coalition building (e.g., [de Waal, 1982](#); [Ostrov, 2006](#); [Roseth, 2006](#)). This level of social facility results in socially dominant children being viewed positively by peers and teachers. For example, socially dominant children have friends ([Charlesworth & La Freniere, 1983](#)) and tend to be central members of their peer group ([Chance, 1967](#); [La Freniere & Charlesworth, 1983b](#); [Pellegrini, Kato, Blatchford, & Baines, 2002](#); [Pellegrini, Long, et al., 2007](#); [Pellegrini, Roseth, et al., 2007](#); [Vaughn et al., 2003](#); [Waters and Vaughn, 1981](#)). One measure of group centrality used by ethologists (e.g., [Chance, 1967](#)), attention structure, measured observationally as the number of conspecifics looking directly at a focal subject, is significantly correlated with preschool children's observed rates of winning dyadic disputes ($r = .34$, [Pellegrini, Long, et al., 2007](#); [Pellegrini, Roseth, et al., 2007](#)), social dominance (r 's from .60 to .68, [La Freniere & Charlesworth, 1983a](#); $r = .4$, [Vaughn & Waters, 1981](#)), observed cooperation ($r = .67$, [Pellegrini, Long, et al., 2007](#); [Pellegrini, Roseth, et al., 2007](#)) and affiliation (r 's from .49 to .60, [La Freniere & Charlesworth, 1983a](#)).

[La Freniere and Sroufe \(1987\)](#), however, found that social dominance was not related to a global measure of social competence in one of the two preschool classrooms they studied. Further, when children's social activity was statistically controlled, the significant correlations between preschoolers' social dominance and social competence ($r = .47$) and attention structure ($r = .65$ and $.62$) were reduced to non-significance. By way of explaining these findings, [La Freniere and Sroufe \(1987\)](#) suggested that the social ecology (number of children enrolled in the two classrooms and differing ratios of children classified as anxiously attached) was responsible for the differences. Specifically, the larger classroom also had a higher proportion of anxiously attached children and correspondingly more social chaos. Consequently, socially dominant children may have withdrawn from social interaction in the larger group, thus social dominance status did not correlate significantly with attention structure or social competence when levels of social activity in the classroom were statistically controlled. Such a strategy is seemingly indicative of social competence.

In adolescence, studies also show that aggression is used to control resources. Two studies showed that use of aggression against their same-sex peers predicted subsequent heterosexual interaction ([Pellegrini & Bartini, 2001](#); [Pellegrini & Long, 2007](#)) and more generally, that aggressive males are viewed positively by their female peers ([Bukowski, Sipola, & Newcomb, 2000](#)). These patterns, consistent with other findings ([Hawley, 2003](#)), suggest that socially dominant children and adolescents are "strategic," not deficient, in their uses of aggression: They seemingly know when to use aggression, when not to use it, and with whom to use it. They use aggression effectively and efficiently against specific

348 targets and tend to win these bouts (Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al.,
349 2007).

350 Interestingly, dominant youngsters do not seem to alienate either peers or teachers, possi-
351 bly because they are also cooperative and prosocial (Hawley, 2003; Pellegrini & Bartini,
352 2001; Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007). Further, and, directly
353 to the point of using aggression strategically, socially dominant preschoolers, defined in
354 terms of using aggression “efficiently” (i.e., children whose ratio of using aggression:win-
355 ~~ning aggressive bouts~~ is relatively high) are not rated by their teachers as aggressive (Pel-
356 legrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007). On the other hand, exhibiting
357 relatively high rates of aggression (relative to all social behavior) without reference to suc-
358 cess, does not predict positive teacher ratings. Children who win competitive bouts also
359 tend to reconcile their peers in post-aggressive encounters, ~~be more cooperative, and~~
360 ~~win dyadic agonistic encounters~~ (Roseth, 2006).

361 In recognizing the co-occurrence of agonistic and affiliative behavior, La Freniere and
362 Charlesworth (1983a) suggested that there were two broad types of social power: One that
363 uses force and submission to exert power and another relying on recognition of status and
364 competence. These differences may be due to the different styles boys and girls use to exer-
365 cise social power with their peers, though sex differences are not robust in the preschool
366 literature. Difference in style may also be due to differences in the social ecologies of dif-
367 ferent classrooms (La Freniere & Sroufe, 1987).

368 A related position to explain the strategic roles of affiliative and agonistic behaviors in
369 social dominance, advanced by Strayer (1980, 1988), is based on young children’s different
370 early experiences. Indeed, Strayer was one of the first developmentalists to document the
371 affiliative as well as agonistic dimensions of social dominance and the impact of both on
372 distal (fitness) and proximal (resource control) functions. Consistent with some traditions
373 in ethology (e.g., Tinbergen, 1963), his research is grounded in carefully conducted direct
374 observations of children in their natural ecologies. Also consistent with an ethological per-
375 spective, Strayer stresses the hierarchical nature of individual social interactions, relation-
376 ships, and groups and the cognitive implications of these different levels of social
377 abstraction (Byrne & Whiten, 1988; Humphrey, 1976).

378 Strayer (1988) posits that individuals construct cognitive representations of their social
379 interactions and relationships and these representations result in individual differences in
380 interaction styles. From this position, he found three clusters typifying preschoolers’ social
381 behavior: socially inactive (low levels of initiated affiliation and agonism), children with
382 moderate levels of affiliation and agonism, and children high in agonism and low in affil-
383 iation. Socially dominant and socially competent children, from Strayer’s perspective,
384 have a variety of behaviors and strategies at their disposal and are able to balance agonis-
385 tic and affiliative strategies appropriately in different settings. He also showed that cluster
386 membership (that is, the degree to which they use agonistic and affiliative behaviors) was
387 not stable across time. The reason for this instability, he suggests, is change in children’s
388 “peer ecology.”

389 With this said, it is important to specify more exactly the extent to which specific social
390 ecologies also differ in terms of forms of competition. In what follows an explanation
391 derived from behavioral ecology theory will be presented. By way of preview, it is sug-
392 gested that the use of aggressive and affiliative behaviors should vary as a function of
393 the costs and benefits associated with different resource competitions in different ecologies
394 (Crook, 1970, 1989). Competition ranges along a continuum from contest competition to

scramble competition where contest competition is typified by aggressive and scramble competition is typified by more affiliative strategies (Parker, 2000). The model presented here will integrate extant findings in the social dominance literature by specifying the competitive contexts under which children and adolescents utilize aggressive and affiliative strategies.

Scramble and contest competition: A view from behavioral ecology

A brief view of behavioral ecology

Variation in observed uses of agonistic, aggressive, and affiliative behaviors in accessing resources can be explained by *behavioral ecological theory* (Krebs & Davies, 1993), generally, and by the different types of competitions specified by this theory. Briefly, behavioral ecology has its roots in optimal foraging theory in biology (Stephens & Krebs, 1986) and anthropology (Borgerhoff Mulder et al., 1997; Cronk, 1991; Winterhalder & Smith, 2000). From optimal foraging theory, behavioral ecologists assume that individuals' behaviors reflect efforts to maximize their fitness, ultimately. More proximally, optimality is assessed by documenting the degree to which benefits (i.e., resources, such as food or mates) are maximized in relation to associated costs (e.g., time and caloric expenditure and mortality). Individuals' strategic choices are influenced by their ecologies and their life histories; thus, individuals choose from a variety of strategies to optimize access to resources and these strategies may vary across the life span.

Life history theory is concerned with balancing the trade-offs between different strategies to individuals' fecundity, survival, and physical conditioning during different points in ontogeny (Lessells, 1991). As such, the choice of a specific strategy involves trade-offs between costs and benefits in how individuals' solve fitness-related problems at different periods in development in different ecologies. In specific reference to social dominance, one's choice of competitive strategies to access resources takes different forms at different times during ontogeny. Sexual selection theory predicts that competitiveness, generally, during the juvenile period should be related to physical size and social dominance, a prediction supported by some extant data (e.g., Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007; Vaughn & Waters, 1981). A specific behavior, such as aggression, may increase the likelihood of accessing a resource, but it also involves costs, such as the possibility of being injured or socially ostracized.

From this theory, the use of a behavior in competitive resource encounters can be predicted according to the value and abundance of the resources being contested, the resource-holding power of the contestants, and the strategies used by other competitors (Krebs & Davies, 1993; Maynard Smith, 1982; Noorwijk & van Schaik, 2004; Parker, 2000). Competition for resources ranges along a continuum from "scramble" competition to "contest" competition (Nicholson, 1954) and the value of a specific strategy or behavior, whether it be aggression, cooperation, or some combination of the two in each type of competition is then assessed (Maynard Smith, 1982).

Scramble and contest competition

A guiding principle in behavioral ecology, as well as sociobiology and ethology (Dawkins, 1976; Laland & Brown, 2002; Wilson, 1975), is that the individual not the group, is

the unit of natural selection (though see Boyd & Richerson, 1985). From this position, individuals compete for resources in specific ecologies and make choices based on the relative costs and benefits associated with a specific behavior or strategy, the costs and benefits of which vary in different circumstances. Consider an example where two individuals are competing for a resource. First, an individual may choose to fight another individual for access to a resource. Fighting is a costly strategy to the extent that one may be injured, killed, or socially sanctioned. The costs associated with fighting are judged against possible benefits. If the resource is valuable (e.g., scarce), a costly strategy, like fighting, is more justified than if the resource is less valuable (e.g., abundant). If the resource is less valuable, then a less costly strategy, such as using a threat or a display, might be more profitable. Threats and displays of physical prowess, such as physical size, are less costly strategies than aggression to the extent that if they are not successful in causing the competitor to concede, the former can “back down” with minimal cost. Strategies and behaviors are used to “optimize” success under these circumstances (Dawkins & Krebs, 1978). The value of the resources being contested and the likelihood of accessing them are crucial dimensions of this formula and they will be addressed in the remainder of this paper.

The most basic form of competition is a *scramble competition*. In a pure scramble situation, and one under “ideal free conditions,” individuals are free to go where they please. Importantly, in these circumstances, all individuals have equal knowledge and each contestant gets some share of a resource of equal value (Parker, 2000). Any form of queuing for a resource is an example of scramble competition. Individuals in a supermarket, for example, can go to any checkout line; each person gets the same resource, getting checked-out, eventually. Use of an expensive strategy, such as aggression, in this situation where access to resources is guaranteed, clearly is more costly than it is beneficial for an individual. Because scrambles, generally, are characterized by relatively abundant resources, where each individual gets some of the resource, individuals are less likely to use aggressive than more affiliative behaviors.

As quality and quantity of resources available vary, we move toward the more contestative end of the competition continuum and, by definition, resources become more valuable. Cases where there are winners and losers in accessing resources are *contest competitions*. In “pure contests,” winners take all, if they choose. In such cases, resources are more valuable than in the scramble case and thus more likely to be accessed by aggression, a relatively costly strategy, the use of which should be off-set by the value of the resource.

Contests unfold sequentially and at all stages, contestants evaluate each others’ capabilities in relation to choosing a strategy to access the resource (Dawkins & Krebs, 1978; Pusey & Packer, 1997). This evaluative process is an on-going and dynamic one, beginning with an initial assessment based on resource-holding power, such as physical size, “toughness” reputation, or allies present (Archer & Benson, *in press*; Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007; Smith and Sluckin, 1977). Subsequent behaviors and strategies should be used and evaluated based on the responses of the contestants. For example, if a threat by A does not result in an opponent B giving ground, A may concede the resource because A does not think the value of the resource merits a more costly strategy. On the other hand, A may escalate to aggression because of a perceived weakness in B. From this view, individuals’ cognitive facilities are implicated in the evaluation, choice, and implementation of strategies (Hawley & Little, 1999).

Because of the paucity of research addressing the different strategies used in explicitly labeled scramble and contest competitions, in the next section studies of social dominance in the human development literature will be reviewed and judgments will be made about the types of competition examined in the research and the corresponding behavioral strategies used to control resources. The most basic prediction is that aggression should be more common in contest competitions and affiliative strategies more common in scramble competitions. Beyond that, affiliative strategies, such as reconciliations, may be observed in contest competitions following the successful use of aggression.

Evidence of affiliative and aggressive behaviors in contest and scramble competitions

Studies of children's and adolescents' resource control do not, generally, explicitly differentiate scramble from contest competition, even though the distinction was discussed in the child development literature by Charlesworth (1988) 20 years ago. This level of specification is important so that results can be integrated into a theoretical frame explaining how variations in context covary with observed rates of aggressive, agonistic, and affiliative behavior. In a few cases, the distinction between contest and scramble competition is clear (e.g., coding wins in resource struggles) while in other cases it is less clear, making it very difficult to make clear inferences about the type of competition under study. In an effort to sort out this confusion, judgments about the types of competition used to assay resource-holding power in the extant social dominance literature will be made, first of preschool children and then of adolescents.

Studies of preschool children

Relatively clear examples of contest competition are those studies of social dominance using the frequency of individuals' dyadic wins, the ratio individuals' dyadic wins:losses, and the summaries of those dyadic contest scores expressed in dominance hierarchies. These types of scores are typically derived from direct observations of individuals' behaviors, as exemplified in the research conducted by ethologically-oriented researchers, such as La Freniere and colleagues (La Freniere & Charlesworth, 1983a; La Freniere & Sroufe, 1987), McGrew (1972), Pellegrini and colleagues (e.g., Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007), Sluckin and Smith (1977), Strayer (e.g., Strayer, 1980, 1988), and Vaughn and colleagues (e.g., Vaughn & Waters, 1981). Behavioral ecological theory predicts that contest wins should correlate positively and significantly with aggression and but not with affiliations.

Beginning with studies of dominance where contest wins are defined in terms of individuals' status in dominance hierarchies derived from dyadic agonistic:submissive relations, Strayer's (1980) direct observational research in four Canadian preschools (two in Quebec, one in Ontario, and one in British Columbia) found, consistent with the behavioral ecological hypothesis, that observed affiliative behavior, generally, did not correlate significantly with place in social dominance hierarchy in any of the samples while agonistic and controlling behavior did. The replication of these findings across a variety of samples is especially noteworthy in supporting the validity of the hypothesis (Lykken, 1968).

Similar results for the role of aggression in contest wins, utilizing a replication sample design (one sample of 11 and one of 12 in Sheffield, UK), were obtained by Sluckin and Smith (1977). They found that observed aggression and place in observed hierarchies

based on dyadic wins in each sample were positively correlated with contest wins at moderate levels (i.e., .46 and .67). However and unfortunately, affiliative behavior was not documented.

McGrew's (1969, 1972) research too utilized extensive direct observations of preschool children (in Oxford, UK), and dyadic wins were used to rank order individuals in a dominance hierarchy. Dominance status (based on dyadic wins) for preschool boys was significantly correlated with aggressive behavior. Interestingly, and similar to Strayer (1988), dominant preschool boys were also very socially active, such that dominance status was significantly related to receiving and directing social contacts (McGrew, 1972). This social interaction, however, was mostly directed at and received by other dominant boys. One explanation of these findings is that children of this age, as they are becoming socially competent, are also trying out a wide variety of behaviors, both affiliative and agonistic, and then use those behaviors that are most effective in specific contexts. Following this logic, Strayer (1988) found that the behavioral typologies that characterized 2/3 of his preschool sample were *not* stable across one year. This instability may have been due to different ecologies, generally (Crook, 1970, 1989), or different forms of competition, more specifically.

To my knowledge there has only been one study in the child development literature explicitly examining the different behavioral predictors of resource control in scramble and contest competitions (Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007). Importantly, this study made within-subjects comparisons of the strategies used to predict resource control in both types of competition. The importance of a within-subjects approach is especially relevant to this area as a number of scholars (e.g., Hawley, 2006; Rowe et al., 2004; Strayer, 1988) have suggested that individual differences play an important role in the strategies used to establish and maintain social dominance.

Pellegrini and colleagues (2007) examined access to resources in explicitly labeled scramble and contest competitions in university preschool classrooms in Minneapolis. Contest wins were defined in terms of the ratio of dyadic wins:total dyadic resource contests observed across a school year as well as teachers' ratings of children in hypothetical contest situations. The scramble measure was an experimental task, developed by Gunnar and colleagues (e.g., Cheatham & Mliner, 2003; Tarullo, Mliner, Gustafson, & Gunnar, 2003), to assess social dominance. This task is considered a "scramble," rather than a "contest," because all children get access to the resource—there are no winners and losers.

Briefly, the procedure 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. 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 procedure. The ticket-event procedure was then repeated, on different days, for three trials of special events: Monkey Hunt, Carnival, and Jungle Party. Rank was computed as the average of

ticket rank in line across the three trials. Importantly, all children actually got to attend all special events.

Consistent with predictions, children's observed cooperative behavior, not aggression, predicted (when age was controlled) access to resources in the scramble competitions, but cooperation *did not* relate to resource control in contests. Further, teachers' ratings of children's social dominance (assessing contest wins), were significantly related to behaviorally observed wins but not to behaviorally observed cooperation.

While being able to predict accurately the degree to which preschoolers use aggressive and affiliative strategies in different forms of competition advances our understanding, it is still a rather simple explanation for the ways in which socially dominant individuals use different combinations of aggressive and affiliative behavior. Game theory leads us to expect that individuals' choices of behaviors during conflicts are dynamic (Dawkins & Krebs, 1978; Pusey & Packer, 1997). From this view, children's initiations and responses are affected by information gained from preceding behaviors and anticipating future behaviors. Thus, it is important to examine sequences of behavior surrounding contests to determine how individuals not only access resources initially (i.e., win) but also how they maintain their social dominance: Being socially dominant entails more than just defeating someone for a resource. After defeating a peer, it would be wise if dominant individuals were to use an affiliative strategy, such as re-establishing social contact with or reconciling their defeated peers. In this way they can build alliances with defeated children (de Waal, 1982, 1993). The relational model of primate conflict advanced by de Waal (1996, 2000) emphasizes how post-aggression interaction and reconciliation affects competitive conflict processes. The model posits that, among other things, the availability of post-aggression mechanisms, like reconciliation, may actually encourage conflict and aggression.

The place of post-aggressive affiliations and reconciliations in competitive encounters, though widely studied in non-human primates (Aureli, Cords, & van Schaik, 2002), has been understudied in children, but where they have been, results suggest that after dominant children use aggression to control resources in contests, they follow-up with an affiliative strategy (Pellegrini, Long, et al., 2007; Pellegrini, Roseth, et al., 2007; Roseth, 2006; Verbeek & de Waal, 2001). It is not enough, however, to show that affiliation occurs after competitive conflict. Instead, it must also be shown that (a) affiliation occurs *more often* after competitive conflict compared to rates of affiliation during free play, and (b) that it occurs *selectively* between former opponents (de Waal, 2000). To test for reconciliation while controlling for these contingencies, de Waal and Yoshihara (1983) developed the post-conflict–matched control (PC–MC) method, otherwise known as the attracted pairs method. In the attracted pairs method, a matched-control (MC) period is observed for each post-conflict period, thus allowing a systematic comparison of affiliative behavior between former opponents on two separate occasions—one after conflict post-conflict (PC), and one at the same time of day but in the absence of conflict (MC). If the first affiliative interaction between former opponents occurs only in the post-conflict, or it occurs earlier in the post-conflict than in the matched control, the opponent pair is said to be “attracted.” If the affiliative interaction takes place earlier, or only, in the matched control, the pair is said to be “dispersed.” An opponent pair is considered “neutral” when (a) no affiliative interaction occurred in either the post-conflict or the matched control, or (b) when the interaction occurred at the same time in both observations. If the timing of the first contact in the post-conflicts is similar to that in the matched controls, then the

number of attracted and dispersed pairs should not differ from the 1:1 ratio expected by chance. If the number of attracted pairs is significantly higher than the number of dispersed pairs, then reconciliation is inferred.

Roseth (2006) utilized the PC–MC method to examine preschoolers' post-conflict reconciliations and found that in 30% of the cases after a contest conflict, individuals remained together, a basic form of reconciliation. This rate is similar to the 32% found by Sackin and Thelen (1984) and the 27% found by Verbeek and de Waal (2001). It is higher, however, than the rate observed by Pellegrini and colleagues (2007) at 17% and far lower than the 83% reported by Ljungberg and colleagues (1999) in Sweden. Such differences in reconciliation are probably related to methodological factors. For example, Ljungberg and colleagues used a relatively long post-conflict lag (6 min), relative to Roseth (2006) (3 min).

Reconciliations, of course, require a fair level of social cognitive sophistication. Individuals must enlist the requisite perspective-taking, theory of mind, and expressive language skills to assuage a defeated peer, in the form of an apology or an offer of a treat, for example. Preschoolers' abilities to understand their peers' thoughts and beliefs are only just beginning to develop (Wellman, Cross, & Watson, 2001), so we would expect limited reconciliation with younger children but it should increase with age. Clearly more research is needed to determine the extent to which preschoolers' reconcile after contest competitions. From a theoretical point of view it is interesting to consider the extent to which theory of mind and perspective-taking develop in the context of peer conflicts (Piaget, 1965) or, alternatively, whether theory of mind is an antecedent to initiating contest competitions and reconciliations.

There is also a commonly used experimental task in studies of social dominance requiring both cooperation and aggression to access resources, and this design feature may be responsible for the co-occurrence of these strategies. In the innovative "movie-viewer" paradigm designed by Charlesworth and colleagues (Charlesworth & Dzur, 1987; Charlesworth & La Freniere, 1983; Green, Cillessen, Berthelsen, Irving, & Catherwood, 2003; La Freniere & Charlesworth, 1987), groups of four children are observed while trying to watch a film from a movie projector that requires cooperation on the part of two children in order for the resource (viewing the film) to be accessed: One child has to turn the crank and the other presses a light switch. Only one child can view the movie at a time. In virtually all of these studies, results indicated that children used both aggression and cooperation to view the movie. This co-occurrence may have been due, in large part to the task requiring cooperation. A child could not have accessed the resource by merely snatching the projector. Indeed, the task was designed to reveal the types of social power children would use in a situation that specified the resource in terms of collective action (La Freniere, personal communication, 11/2007).

Children's expectations of accessing resources, or the extent to which the competition is closer to scramble or contest competition, is another important factor in movie paradigm studies that may have affected children's behavior. Specifically, Green and colleagues (Green et al., 2003) observed quartets of children in the movie-viewer paradigm and all members of the quartet got to view the film by the end of the sessions. That is, while some children got access to the viewer before others, all eventually accessed the resource; thus, this task more closely resembles a scramble competition rather than a contest, and, consistent with behavioral ecological predictions, should result in using affiliative strategies. Similarly, in one of the movie-viewer studies (Charlesworth & La Freniere, 1983), teachers

told preschoolers that they should “take turns” (p. 177), the implication being that all children would get a turn. In the Charlesworth and Dzur experiment (1987) mention of taking turns was *explicitly avoided* (La Freniere, personal communication, 11/2007). In related experimental work by La Freniere and Charlesworth (1987), it was noted that only low-status children did not gain access to the resource. In short, the combination of the design of the movie paradigm task and the demand characteristics of the assessment context in two of the reports probably skewed results towards high levels of affiliation being used to access resources.

Sex differences are also mixed in this paradigm, as with the research using direct observations in preschoolers’ natural ecologies. For example, males, more than females, spent timing viewing the movie in one study (Charlesworth & La Freniere, 1983) but not another (La Freniere & Charlesworth, 1987). It may be the case that children in these samples, who are typically affiliated with university preschools, do not exhibit physical aggression—the form of aggression associated with sex differences.

Future research should, in addition, consider the extent to which young children use adults to help them mediate control of resources. In many social settings in industrialized society, children’s social interactions are mediated by adults (Blatchford, 1998) and consequently accessing limited resources may depend on children’s ability to appeal to adult intervention. In schools imposing high costs for using aggression, a beneficial strategy to access limited resources might entail Child A asking a teacher for a share of a resource because Child B had taken all of it. In this way Child A not only accesses the resources but also damages the reputation of Child B, a competitor.

To conclude this section, the limited evidence available provides equivocal support for the hypothesis that preschoolers use of aggression in contests and affiliative strategies in scrambles. While aggression tends to be used in contests, there is also evidence suggesting that affiliation co-occurs with agonism (e.g., La Freniere & Sroufe, 1987). In some cases affiliation occurs in post-conflict reconciliation, after the initial aggressive overture (Roseth, 2006). These post-contest affiliations are further evidence of the affiliative function of aggression in the context of social dominance relationships during the preschool period. Given the paucity of research directly testing contest/scramble competition hypotheses, much more research is needed.

Studies of early and late adolescents

During adolescence antisocial and aggressive behavior are more acceptable to youngsters, thus there is more likely to be a positive relation between uses of aggression and social standing with same-sex peers (Cairns & Cairns, 1988; Graham & Juvonen, 1998; Moffitt, 1993; Pellegrini, 2002) and opposite-sex peers (Bukowski et al., 2000; Pellegrini & Bartini, 2001; Pellegrini & Long, 2003, 2007). Correspondingly, social cognitive facilities are advanced for adolescents, relative to preschoolers, thus they are capable to coordinating different behavioral strategies, such as the deceptive use of aggression, with peers (Sutton, Smith, & Swettenham, 1999a, 1999b). The ability to access a variety of strategies, both deceptive and prosocial, is probably an asset in social dominance encounters. For example, Tremblay and colleagues (Tremblay et al., 1993) found that socially dominant adolescent males were more reflective, relative to non-dominant males, after using aggression.

An example of contest competition in adolescence involves youngsters competing for access for opposite-sex relationships (Charlesworth, 1988; Low, 2000). Specifically and fol-

lowing sexual selection theory, females who are the most attractive are also the most sought after by males (Buss, 1989). Consistent with this position, female adolescents compete with each other in terms of physical attractiveness (Savin-Williams, 1987; Weisfeld, Bloch, & Ivers, 1984). Further, females choose males, based on λ resource-holding power indicators (Buss, 1989; Pellegrini & Long, 2003).

Evidence to support hypothesized sex differences in the use physical attractiveness and aggression to access resources in adolescence is mixed. Research supports the hypothesis that males' aggression used in intra-sexual contests relates to contact with the opposite sex. First, using diary reported rates of aggression and peer nominations of invitations of opposite-sex peers to a hypothetical party, Pellegrini and Bartini (2001) found that boys' aggression predicted their being nominated by girls to be hypothetical dates. Correspondingly, a significant relation was reported between peer nominations of aggression and opposite-sex friendship in a Canadian sample of adolescents (Bukowski et al., 2000). Similar findings for the role of adult male aggression in accessing heterosexual contact has also been documented in the anthropological literature, where male warriors, relative to other classes of males, have more sexual partners (Chagnon, 1988) and in the sociological literature where male gang members, relative to other males, have above average mating opportunities (Palmer & Tilley, 1995). Aggressive males are attractive to many females.

Aggression may have been an especially appropriate male strategy to access resources, including heterosexual contact, in the studies of adolescents in school settings for at least two reasons. First, in the Pellegrini and colleagues and Bukowski and colleagues studies youngsters were either making the transition from primary to secondary school or recently enrolled in secondary school; both are particularly disruptive times in the lives of early adolescents, especially their peer relations (Wigfield et al., 2002). Similarly, in Savin-Williams' (1987) studies of youth and adolescents (age 12–17 years old) at summer camp, he too found that rates of agonism λ decreased, with time, as youngsters came to know each other and sort out hierarchical relationships. As we have seen, during these transitions, aggression increases initially and is used to establish social dominance; it then decreases after social dominance has been established. Thus, aggression is both common as well as an indicator of social status. Secondly, adolescence, relative to childhood, is a time when youngsters tend to endorse aggression (Moffitt, 1993).

However, predicted sex differences in the use of aggression to access heterosexual contact was not supported in study by Pellegrini and Long (2007), who directly observed middle school students (age 12–14 years olds) at monthly dances across a school year, a prime, but under utilized, venue for studying heterosexual interaction (Low, 2000). While they found that aggression predicted cross-sex contact, there were no significant sex differences. This finding may have been due to the difficulty of directly observing relational and indirect aggression, common to females.

Predicted sex differences in the role of females' physical attractiveness in predicting heterosexual contact is mixed, as well. Buss' (1989) cross-national survey points to the importance of adult females' physical attractiveness in their being chosen as mates. On the other hand, Pellegrini and Long (2007) predicted that females', not males', physical attractiveness, would predict cross-sex contact at monthly school dances. While physical attractiveness did predict cross-sex contact, it did so for both boys and girls. That teachers, rather than the youngsters themselves, rated attractiveness may have been responsible for these results. The difference between the samples in age, with Buss' being adults and Pellegrini and Long's being middle school students, 12–14 years old, may also be responsible for the mixed results.

Looking more generally at the coercive and prosocial strategies to access resources in adolescence, Hawley (2003a) examined the relative roles of different strategies in resource control with a sample of 14-year-old Berlin youth. Hawley (2003) used both peer nominations of resource control (e.g., Who's the best at getting what they want? Who usually gets attention from others?) and self-reported ratings of strategies used to control resources (e.g., I often bully or push others to do what I want, as a coercive strategy used to access resources; I influence others by doing something in return). The self-reported ratings were used to categorize individuals into separate resource control groups: Bistrategic (using both prosocial and coercive), coercive, prosocials, typicals, and non-controllers. Regarding sex differences, she found that boys, more than girls, were coercive controllers and girls, more than boys, used prosocial strategies.

Hawley also noted that because of the large sample size ($N > 1700$), effect sizes, not p -values, would be used to determine the significance of correlation coefficients, thus, only r 's of greater than .31 were considered significant. By this criterion, the correlation ($r = .22$) between self-reported ratings of resource control and peer nominations of resource control was not significant; nor were the correlations between self-reported resource control and two measures of peer affiliation, peer-nominated popularity (.03) or perceived popularity (.15). Similarly, peer-nominated resource control was not significantly related to peer-nominated popularity (.24), but was significantly related to perceived popularity (.67). The general paucity of significant correlations, using Hawley's *a priori* set criterion, between resource control and popularity is consistent with hypotheses advanced in this paper. More specifically, if we assume that resource control as measured by Hawley is an approximation of controlling resources in contests, then it should not, according to my hypothesis, be related to a measure of affiliation, such as popularity.

However, when peer-nominated popularity was examined in relation to the type of resource-control groups into which youngsters were classified, the bistrategic and prosocial groups were above average and not different from each other. The coercive group, however, was around average. These findings are inconsistent with the hypotheses advanced in this paper that contest wins, or in this case controlling resources using elements of coercion, should not be positively related to dimensions of affiliation, like popularity. However, when these same groups were compared on teachers' rating of their social acceptance (e.g., Gets along well with other students, Can talk with others when person problems arise), the bistrategic and prosocial groups, again were above average and the coercive group was least accepted. That the coercive group was least accepted is consistent with the hypotheses advanced in this paper.

In another study of adolescents, Savin-Williams (1987) used a variety of direct and indirect measures verbal, social, and physical agonistic behaviors to determine adolescents' social dominance rank in the context of a residential summer camp. Importantly, these social dominance-related behaviors were coded in the context of one individual controlling another. These dyadic encounters were then used to construct dominance hierarchies and rank order individuals, thus fitting the definition of contest competitions. Savin-Williams (1987) found that social dominance was not related to sociometric popularity, nor was there a significant relation between dominance rank and rating of being the "counselors' favorites." On the whole, these analyses are generally, though not uniformly, consistent with the hypotheses advanced in this paper that strategies used in contests tend not to relate to peer affiliation.

Sequences of behavior in social dominance bouts

As noted above, interactions during contests unfold across time. Consideration of how summary measures of aggression or affiliation predict resource control overly simplifies the process, as indicated by game theoretical models (Stephens & Krebs, 1986) as well as empirical studies (Roseth, 2006; Roseth et al., 2007). In trying to identify when, in the course of group stabilization, aggression and affiliation were used to control resources, Pellegrini and Bartini (2001) found that aggression (both self-reported and diary recorded) but *not* affiliation (peer nominations and self-reports measures of affiliation) predicted a contest-oriented measure of teacher-rated social dominance in the fall of the sixth grade. In the spring of the sixth grade, however, both measures of affiliation, and only one measure of aggression (the diary measure) predicted social dominance. Similar to the results discussed above for preschoolers (Roseth, 2006; Roseth et al., 2007), socially dominant individuals used aggression to establish dominance at the start of the school year and later in the year they were more affiliative as rates of aggression waned.

Different temporal patterns were also reported by Savin-Williams (1987) in his summer camp observations of adolescents. He found no relation between boys' and girls' social dominance and one form of affiliation, sociometric popularity, either early or late during the four-week period. The inconsistencies between the two studies may be due to the fact that Savin-Williams did not directly observe cooperative behavior. Cooperation, though typically related to sociometric popularity, is not equal to it. Further, the small size of the cabins in the Savin-Williams study (between 4 and 6 youngsters in each), relative to the more than 20 youngsters/homeroom in the Pellegrini and Bartini (1981) study, may have resulted in agonistic individuals being harder to avoid and thus less liked.

These results point to the importance of trying to identify more exactly the processes associated with the strategies and behaviors used to access resources at different points in the history of a group. In the Pellegrini and Bartini (2001) case, aggression was used to *establish* social dominance and affiliative strategies were used to *maintain* it. Indeed, the idea of resource control may be too general to the extent that one set of strategies, such as aggression, may be used to *access* resources in contests but another set of more affiliative strategies may be more successful in *maintaining* control of resources.

Conclusion

The role of aggression in children's and adolescents' lives, until recently, has been discussed by developmental psychologists in terms of social cognitive deficits. The infusion of evolutionary-oriented theory into this discussion has challenged this assumption. The ubiquity of aggression among invertebrate and vertebrate species suggests that it has probably been naturally selected and thus functional and not indicative of a deficit. Much of the research in developmental psychology following this evolutionary orientation has tried to explain the functional dimensions of aggression in terms of social dominance where a combination of aggressive and affiliative strategies relate to individuals' resource control, social competence, reduced group-level aggression, and increased social cohesion.

This review extended this discussion by, first, supporting the claim that aggression is strategically used in dominance bouts. This review also extended extant work by embedding it in a behavioral ecological frame. The theory specifies that different behaviors are used to control resources depending on individuals' resource-holding power and the value

of the resource at hand. In this paper, stress was placed on the role of two types of resource competition. Scramble competition, where everyone accesses resources, elicits higher levels of affiliation than aggression. Contest competition, where winners take all, elicits higher levels of aggression and lower levels of affiliation. These predictions were supported equivocally in the literature. Certainly more specific tests of these predictions are warranted given the relative paucity of research explicitly addressing these issues.

Perhaps most importantly, this review also suggested that different strategies are probably used at different times in the history of group formation. Specifically, there was some evidence suggesting that aggression seems to be used in initial encounters as a group is being formed. After resources are secured and individuals recognize their relative status in the group, aggression decreases and affiliation increases. In adolescence, Pellegrini and Bartini (2001) found these different patterns across a school year. At a more micro-analytical level, Roseth's (2006) work with preschoolers, following deWaal's theorizing (1982), demonstrates that dominant individuals, relatively soon after winning contest competitions with peers, will either affiliate with them by remaining next to them or explicitly reconciling them. It may be the case that dominant individuals reconcile peers to keep them as allies, to form coalitions, or to keep them as friends. A very important implication of this line of reasoning is that future research should not only document the ways in which different strategies are used to control resources, but a distinction should be made between accessing and maintaining control of resources. Both theory and empirical findings suggests that different strategies should be invoked.

There are important methodological implications of these recommendations. First, researchers must begin to examine behavior in terms of its place in a sequence of behaviors, not as summary variables aggregated across time. As demonstrated with observations of preschoolers, aggression may be used initially to access resources in contests, but within a few minutes, the winners of these contests affiliate with their peers, often reconciling them. Thus, it seems much too simple to treat social behaviors as isolated variables impacting an outcome. While this type of thinking fits neatly into regression models, it does not accurately model social interactive processes. The natural ecology of social interaction does not unfold in these terms; individuals' behaviors are typically contingent on the preceding behaviors of their peers. While some theory, such as game theory, and indeed common sense, points in this direction, our research methods and analytic strategies have yet to follow. Utilization of dynamic models with longitudinal data sets (e.g., Long & Pellegrini, 2003) would provide important tools to examine the moderating roles of both cooperation and reconciliation on trajectories of contest-related aggression. Specifically, while we know that aggression decreases with time as groups stabilize, we do not know the specific mechanisms moderating this decline; it may be that reconciliation, cooperation, or both, moderate this effect.

Though generally ignored in the extant social dominance literature, the use of different strategies to access and maintain resources clearly implicates children's and adolescents' social-cognitive processes. The evidence presented in this paper suggests that use of aggression is strategic among preschoolers and adolescents alike. Future research, following Sutton et al. (1999a, 1999b), should examine the role of individuals' social-cognitive status in their uses of aggression and affiliation to access resources. For example, is theory of mind an antecedent to children's use of aggression to access resources and then reconcile? Or, are children's social cognitive skills sharpened during the course of negotiating with peers (Smith, 1988)?

Perhaps most importantly, this review has highlighted the role of different forms of competition in eliciting aggressive and affiliative strategies. This distinction has been discussed in the ethological literature (Nicholson, 1954) for over 50 years and in the child development literature for at least 20 years (Charlesworth, 1988), yet only one published empirical paper could be located explicitly using the distinction, and the findings in that paper were consistent with behavioral ecological theory. Such variation in types of competition is important to address. Experimental, within-subjects, studies would be especially important to conduct in order to examine the degree to which individual differences interact with different types of competition. It may be, for example, that introverted, relative to extroverted, children are likely to be more accurate in assessing the costs and benefits of different sorts of competitions and thus likely to access resources in ambiguous situations (e.g., Hawley, 2006).

Correspondingly, it is important to specify what constitutes resources for children and adolescents as it has been a relatively understudied enterprise (Charlesworth, 1988). For preschoolers' contests, toys seem to be important (Smith & Connolly, 1972, 1980), though the type of toys preferred by boys and girls is different (Pellegrini & Perlmutter, 1989). For many adolescents, access to heterosexual contact is important (Charlesworth, 1988; Low, 2000). Experimental studies where children are observed contesting limited resources would be useful.

Relatedly, there is a need for different sorts of scramble and contest competition tasks that can be used in future research. The scramble task developed by Gunnar and colleagues (Mliner, Cheatham, Tarullo, & Gunnar, 2005) is a step in that direction. "Games," such as egg or treasure hunts, can easily be adapted to preschool settings to assess resource control under scramble conditions. However, it is also important in such tasks that researchers stress with children that all children will get similar levels of rewards. The degree to which children perceive that they will access fewer resources or have delayed access to those resources rewards will probably result in their treating the competition less as a scramble and more like a contest.

On the other hand, while there is a need for hypothetical contest competitions, where dyads compete for limited resources, such as a snack, these tasks pose what could be an ethical dilemma. It is especially important to construct contests where all individuals, or at least all same-sex individuals, interact with each other, as in Hawley and Little's (1999) use of a social relations model.

The fact that there are winners and losers is problematic to many educators and parents. Further, there is the real (and indeed predicted) possibility of contests eliciting aggression. In these cases, close adult supervision of contests is essential. Alternatively, researchers could ask teachers to rate all possible pairs of individuals in their classes (as the winner, loser, or a tie) on a hypothetical contest (Hawley & Little, 1999). These ratings, in combination with naturally occurring win:loss ratios, would be a valid indicator of resource control in contest competitions. Correspondingly, hypothetical contests could be presented to individual children, of the sort used in social problem solving scenarios (e.g., Shure, 1985). For example, a child could be shown a picture of two children approaching a swing and told: John and Frank both want to play on the swing, what should John do to get the swing?

The role of adults in children's social dominance has been ignored in virtually all of the research. Adults clearly play a role in juveniles' social dominance in a number of non-human primate species (Pusey & Packer, 1997). For example, juveniles may "inherit" their

mothers' dominance status and mothers moderate their offspring's access to resources. Following this logic, it may be the case that the relationships between children and influential adults in different social ecologies, such as their teachers, buffer children's peer relations and access to resources.

Lastly, the role of gender in social dominance relationships needs further examination. The explicit guidance provided by sexual selection theory suggests that differences should exist. Hypotheses derived from this theory have been generally supported in adolescence (e.g., Hawley, 2003; Pellegrini & Bartini, 2001) and adulthood (Buss, 1989), but the results are more equivocal during early childhood. Employing direct observational techniques to access indirect and relational aggression, following the research of Savin-Williams (1987) with adolescents and Ostrov (2004) with young children, may reveal differences, especially if research participants are drawn from more varied backgrounds.

Uncited references

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