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## Evolution and development of boys' social behavior<sup>☆</sup>

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### Abstract

An evolutionary analysis of the dynamics of one-on-one and coalitional male–male competition provides a theoretical frame for conceptualizing the evolved functions and proximate developmental forms of the social behavior of boys, and for appreciating why the behavior of boys differs from that of girls. We propose the accompanying selection pressures favored the evolution of motivational and behavioral dispositions in boys and men that facilitate the development and maintenance of large, competitive coalitions and result in the formation of within-coalition dominance hierarchies. Empirical research on boys' social development is reviewed using this frame and implications for interpreting boys' social behavior are explored.

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Sex differences in social behavior have been systematically documented for more than 100 years (e.g., Acher, 1910; Woolley, 1910, 1914), and studies conducted during the last several decades have revealed that many of these differences are found in every culture in which they have been studied (Best & Williams, 1993; La Freniere, Strayer, & Gauthier, 1984; Maccoby, 1998; Whiting & Edwards, 1988). Early in the 20th century, the prevailing view was that the origin of human sex differences rested

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with socialization and cultural influences (Woolley, 1910). In 1914, Woolley considered and then rejected the possibility that human sex differences might be related to Darwin's (1871) sexual selection (described below). Since that time and until the emergence of evolutionary psychology (Buss, 1989), there was little consideration that human sex differences might be related to human evolutionary history, although hormonal influences on the expression of some sex differences were acknowledged (Maccoby & Jacklin, 1974). Even with the renewed application of evolutionary principles in psychology and the demonstration that observed behavior and its development often result from an interaction between the genotype and experience (Caspi et al., 2002; Gottlieb, Wahlsten, & Lickliter, 1998), prevailing models of the origin of human sex differences continue to emphasize socialization and cultural influences (Wood & Eagly, 2002).

Despite the continued reliance on socialization-based explanations of the origin of sex differences, the emphasis of modern empirical studies has changed. In the latter half of the 20th century, there were a number of solid empirical studies of social behavior among girls (Eder, 1985; Eder & Hallinan, 1978; Waldrop & Halverson, 1975), and of sex differences in affiliation patterns (see Maccoby & Jacklin, 1974). However, the behavioral aggression and social dominance among and within groups of boys were more thoroughly studied than the nuances of girls' relationships (e.g., DiPietro, 1981; Maccoby, 1988; Sherif, Harvey, White, Hood, & Sherif, 1961). These nuances are now the foci of many research endeavors, with some scientists studying the nurturing aspects of the social style of girls and women (Taylor et al., 2000), and others the competitive aspects (Crick, Casas, & Mosher, 1997; Feshbach, 1969). The counterpart to the focus on girls' and women's social behavior appears to be an emerging bias to explicitly or implicitly cast the social behavior of boys and men as too aggressive, "egoistically dominant" (Whiting & Edwards, 1988, p. 270), "demonic" (Wrangham & Peterson, 1996, p. 167), or somehow lacking in the ability to form close, intimate relationships (e.g., Taylor et al., 2000). Although these sentiments are not an explicit feature of the work of many social scientists, there is still an implicit contrast of the behavior of girls and boys in much of this work, which is more polemic than it need be.

In any case, much of the work has not firmly placed the different social styles and presumable motives of girls and boys in a broader evolutionary context. To be sure, there are evolutionary models of sex differences in social behavior (Wrangham & Peterson, 1996), but these tend to focus on adulthood and thus have not fully integrated developmental sex differences. Research that has been developmental in focus (e.g., Archer, 1992, 1996; Bjorklund & Pellegrini, 2002; Eibl-Eibesfeldt, 1989; Geary, 1999, 2002a; MacDonald, 1992) has not fully considered social sex differences in terms of the cost-benefit trade-offs that are common to evolved systems (Williams, 1957) and social relationships (Trivers, 1974). For instance, the benefits of the emotional intimacy that often develops between dyads of girls and women are frequently emphasized in current work (Belle, 1987; Taylor et al., 2000), but the costs of these (e.g., time) relationships among girls and women are only recently being considered (Bond, Carlin, Thomas, Rubin, & Patton, 2001; Crick et al., 1997; Geary, 2002b). These costs place constraints on the phenotypic development of girls'

relationships and on the evolution of any social and motivational biases that may guide this development.

Our proposal is that sex differences in observed motivational and behavioral dispositions can be understood in terms of different selection pressures for males and females during human evolution, following Darwin (1871). We add to Darwin's model by developing a framework for understanding the evolution of social sex differences and their proximate expression in terms of the cost-benefit trade-offs that arise with different forms of social relationship. The framework is presented in the second section. In the first section, we describe the basics of Darwin's theory, specifically sexual selection (see also Andersson, 1994; Geary, 1998), and in doing so provide the background for understanding the aspects of boys' social activities that we focus on in the third section. In this section, we propose that many central aspects of boys' social behavior, such as rough-and-tumble play and group-level competitive play, can be traced to sexual selection, specifically an evolutionary history of coalitional male–male competition and the formation of within-coalition dominance hierarchies.

## **Sexual selection**

Sexual selection is defined by the species' reproductive activities. Most broadly, these activities involve competition with members of the same sex for mating partners (intrasexual competition) and choosing mates (intersexual choice; Andersson, 1994). Discussion of why the sexes often differ in the form of intrasexual competition and the intensity and foci of intersexual choice is beyond the scope of this treatment. But briefly, the sex that invests the most in parenting is the choosier sex and the sex that invests the least engages in more intrasexual competition over access to mates (Clutton-Brock & Vincent, 1991; Trivers, 1972; Williams, 1966). In most mammalian species, males invest little in parenting and invest heavily in competition for mates, whereas females invest heavily in parenting and are the choosier sex (Clutton-Brock, 1989). Humans are unusual in that men often invest in their children, albeit not as much as women do (Geary, 2000). The result is male choice, female–female competition, as well as female choice and male–male competition (Geary, 1998). Our focus is on male intrasexual competition and thus in the respective sections we provide illustrations of how intrasexual competition creates selection pressures, and how these pressures may have shaped human sex differences.

### *Intrasexual competition*

For males, one of the more common expressions of intrasexual competition involves one-on-one physical threats and fights (Andersson, 1994). The result is a hierarchy, whereby the most dominant males have preferential access to mates or gain control of the resources that females need to raise offspring (e.g., nesting spots). In some species, male–male competition occurs between coalitions and involves one-on-one competition within coalitions (Wrangham, 1999). A behavioral disposition to

form competitive coalitions appears to evolve only for species in which coalitions are more likely to gain access to mates than are lone individuals. The primary cost of coalitional behavior is that sexual access to females must be shared among coalitional males, with a corresponding decline in the number of offspring sired by each male. The reproductive cost of coalition formation is, however, reduced if coalition members are related, as two offspring sired by a brother are genetically equivalent to one offspring sired by the individual (Hamilton, 1964). The dynamics of coalition formation have been extensively studied in lions and support theoretical expectations (*Panthera leo*; Packer, Gilbert, Pusey, & O'Brien, 1991; Packer et al., 1988). Coalitions readily outcompete lone males for access to prides. Although lions will occasionally form alliances with non-kin, these coalitions tend to be small and thus less competitive. The largest and most competitive coalitions are among brothers and other male kin, as predicted.

One of our closest relatives, the chimpanzee (*Pan troglodytes*), also engages in male–male coalitional competition (de Waal, 1982; Goodall, 1986; Mitani & Watts, 2001; Watts & Mitani, 2001). Chimpanzee communities are defined by coalitions of related males that defend a territory. Situated within this territory are sub-groups of females and their offspring (Wrangham, 1986). Within these communities, small coalitions of males cooperate to achieve social dominance over other male coalitions (Mitani, Merriwether, & Zhang, 2000). Successful coalitions gain some level of control over other community members (Riss & Goodall, 1977) and through this attempt to monopolize sexual access to estrous females (Goodall, 1986). The finding that coalitions are sometimes formed between distantly related males (Mitani et al., 2000) suggests very strong reproductive benefits to coalitional behavior in male chimpanzees.

The development and maintenance of coalitions is a complex social endeavor that requires a balance of cooperative and competitive motivational dispositions and behavioral strategies (de Waal, 2000). Coalitions need to be large enough to be competitive but not too large, given the reproductive cost of shared mating. Because competitiveness is determined by the coalitional behavior of other males, and because males will often shift alliances, there is no fixed optimal coalition size. Rather, the optimal size is constantly changing, depending on the dynamics of male relationships. To complicate matters further, males compete for position in the within-coalition dominance hierarchy (Goodall, 1986). Although this conflict results in social instability, once the hierarchy is established social relationships for all community members tend to be stable and less conflicted (de Waal, 1993). Once the hierarchy is established, dominant males have preferential mating access to females and appear to organize the social behavior of other males. The latter facilitates between-group coalitional competition (Goodall, 1986).

### *Sexual selection and human evolution*

Because one-on-one male–male competition tends to be physical, sex differences in physical size are suggestive of an evolutionary history of male-on-male intrasexual competition, as shown in Fig. 1 (Andersson, 1994). Nonetheless, it is difficult to

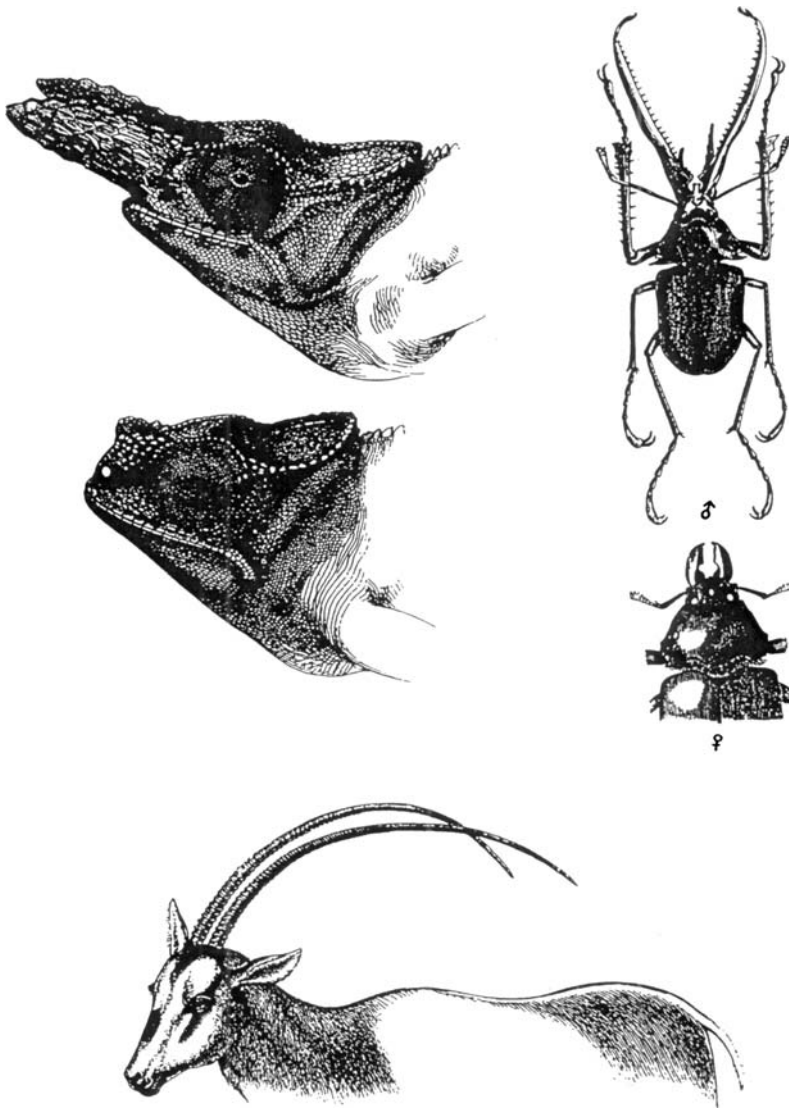


Fig. 1. Examples of sexually selected characteristics used in physical male–male competition. To the upper left are the male (top) and female (bottom) of the *Chamaeleon bifurcus*; to the upper right are the male and female of the beetle *Chiasognathus grantii*; and at the bottom is a male *Oryx leucoryx*, a species of antelope. [From Darwin (1871, Vol. II, p. 35; Vol. I, p. 377; & Vol. II, p. 251, respectively).]

make strong inferences about the exact form and intensity of this competition, especially in instances when the competition is coalitional (Plavcan, 2000). It appears that coalitional competition shifts the selection pressures, to some degree, from physical to social-cognitive, and thus results in a reduction of the size of the physical sex difference (Wrangham, 1999). Either way, sex differences in physical size and related

traits, such as musculature, tendency to engage in physical aggression, and so forth enable inferences to be drawn about the dynamics of sexual selection during the species' evolutionary history.

### *Physical sex differences*

There are a myriad of human sex differences consistent with an evolutionary history of physical male–male competition (Geary, 1998). There are male advantages in physical size, musculature, cardiovascular capacity, bone density, and a host of other physical and physiological traits (Tanner, 1990). There is, in fact, evidence of a male advantage in physical size and some sex differences in bone architecture for all species of hominid (i.e., bipedal apes), including the ancestors of modern humans (e.g., McHenry, 1991). The combination of the fossil record and existing physical sex differences suggests at least a four million year evolutionary history of physical male–male competition in the human lineage (Leakey, Feibel, McDougall, & Walker, 1995; Leakey, Feibel, McDougall, Ward, & Walker, 1998). Current sex differences in behavioral aggression and especially male-on-male violence—male-on-male homicide is 30–40 times more common than female-on-female homicide—add weight to the position that men's physical development as well as their social behavior have been shaped by sexual selection, including physical one-on-one competition (Daly & Wilson, 1988; Geary, 1998).

A sex difference in physical size and tendency toward physical aggression does not mean that our female ancestors (or women today) were not physically aggressive. Across primate species, female-on-female physical aggression is just as common as male-on-male physical aggression (Silk, 1993). However, female aggression is less intense (i.e., it results in fewer injuries and fewer fatalities) than male aggression, and unlike males is typically over control of food or territory that contains food sources (e.g., fruit trees), not mates (Wrangham, 1980).

### *Coalitional competition*

Full discussion is beyond the scope of the current article, but considerable evidence is consistent with a long evolutionary history of coalitional male–male competition in humans (see Geary, 1998; Geary & Flinn, 2001; Wrangham & Peterson, 1996). Group-level competition and hostility is, for instance, found in human populations throughout the world today; is largely a male endeavor; and is largely over resource control and control of reproductive opportunity (Chagnon, 1988; Horowitz, 2001; Keeley, 1996). A common result is a reproductive advantage for successful coalitions, particularly for the dominant men of these coalitions (e.g., Betzig, 1986). Conversely, in some traditional societies men who do not participate in coalitional activities have lower social status and fewer children than men who compete in coalitions (Chagnon, 1988).

Population genetic studies suggest that the reproductive displacement of one group of males by another group of males has been a recurrent theme during human evolution. In one study, Carvajal-Carmona et al. (2000) analyzed the mtDNA- (inherited from mother) and Y-chromosome (inherited from father) patterns for a Columbian (South America) population established in the 16th–17th centuries.

The results revealed the maternal ancestry of this population was largely (>90%) native South American, whereas the paternal ancestry was largely (94%) European. When combined with historical records, these genetic patterns paint a picture of male–male competition in which coalitions of European men reproductively displaced Amerindian men. Related studies have found similar though less extreme patterns in other South American and North American populations (Bortolini et al., 1999; Mesa et al., 2000). Likewise, related genetic analyses suggest a repeating pattern of one population of men replacing another population in Africa, Europe, and Asia (Underhill et al., 2001; Wells et al., 2001).

### *Philopatry*

Philopatry, or the tendency of members of one sex to stay in the birth group and members of the other sex to migrate to another group, provides an important frame for understanding the social ecology of human evolution. Male-biased philopatry in chimpanzees, bonobos (*P. paniscus*), and humans in traditional societies suggests that the modal social ecology during human evolution was male philopatry (Foley & Lee, 1989; Ghiglieri, 1987; Goodall, 1986). There is, of course, variability in migration patterns across chimpanzee, bonobo, and human communities, but the prototypical pattern is for females to migrate and males to stay in the birth group (Pasternak, Ember, & Ember, 1997; Seielstad, Minch, & Cavalli-Sforza, 1998). In traditional settings, about 2/3 of societies are patrilocal, that is, the woman migrates to the community of her husband, and around 15% of societies are matrilineal, that is, the man migrates to the community of his wife (Murdock, 1981; Pasternak et al., 1997). Even when the man migrates, he typically lives near (often in the same village as) his male kin and remains socially and politically engaged with these kin.

Additional evidence for male-biased philopatry comes from population genetic studies that reveal that men in most local communities are more closely related to one another than are women, but women have more kin ties to other communities in the region (Seielstad, 2000; Seielstad et al., 1998; Wells et al., 2001). The genetic and historical records also suggest that more distant migrations are typically male-biased (e.g., Hammer et al., 2001; Semino et al., 2000). In these situations, a coalition of men from the local community leaves, often temporarily, but not to marry women from another community. Rather, they are exploring in search of additional trade routes, or in search of other ways to gain additional reproductive and material resources.

An evolutionary history of male-biased philopatry does not mean that women do not have an evolved motivational disposition to maintain ties with kin, they do (MacDonald, 1992). In fact, the motivation may be stronger in women than in men, because it may have occurred with little effort for men throughout human evolution, but only with considerable effort for women. In any event, a male-biased community would result in a context in which daily social interactions for females would often be with non-kin, but the majority of daily social interactions for males would be with kin (de Waal, 1993; Geary, 2002b). The predicted sex differences in motivational and behavioral dispositions as these relate to same-sex social relationships are discussed below.

## Evolution of social behavior

We provide the background for conceptualizing the dynamics of coalition formation and intracoalition behavior in boys and men. To fully evaluate these dynamics, we first discuss the social ecology of human evolution and then consider the cost-benefit trade-offs of different forms of social relationship in this form of ecology.

### *Social ecology*

#### *Proximate mechanisms*

When the population genetic studies described in the section above are combined with evidence for (a) coalitional male–male competition and (b) migration patterns in closely related species, it seems likely that the modal social community during human evolution consisted of groups of closely related males, females who emigrated from other communities, and their children (Foley & Lee, 1989; Ghiglieri, 1987). With this form of social community, the proximate motivational and social dispositions that facilitate relationships and cooperative activities among boys and men should differ in some respects from those that facilitate relationships and cooperative activities among girls and women. This is because the motivational and social dispositions of males would have evolved in a social ecology populated by relationships among kin, whereas these dispositions in females would have evolved in a social ecology largely populated, with the exception of their children, by non-kin (Geary, 2002b).

Although conflicts of interest occur, relationships among kin are generally associated with nepotism, high levels of cooperation, muted aggression, and tolerance of non-reciprocal relationships (Daly & Wilson, 1988; de Waal, 2000; Hamilton, 1964; Trivers, 1974; West, Pen, & Griffin, 2002). Relationships with non-kin tend to be less stable, more conflicted (Daly & Wilson, 1988), and are predicted to evolve only in contexts in which cooperation results in mutual and reciprocal benefits. More precisely, relationships based on reciprocal altruism should result in the evolution of proximate social and emotional mechanisms that function to ensure equality of the benefits received from the relationship (Trivers, 1971), and this appears to be the case (Hartup & Stevens, 1997). Among these proximate mechanisms are guilt for a failure to reciprocate; monitoring of the give-and-take of the relationship; and feelings of anger, betrayal, and ultimately rejection of relationship partners who do not fully reciprocate.

#### *Social activities*

As predicted, in many traditional societies, men cooperate to form kin-based coalitions that in turn compete with other male kin groups. The competition is manifested as warfare over control of life supporting ecologies (Kaplan, Hill, Lancaster, & Hurtado, 2000), as well as control of reproductive dynamics (Chagnon, 1988; Ember, 1978; Knauff, 1987). An example of the former is conflict over control of the groups' hunting territory, and examples of the latter include political negotiations for marriage partners and raiding to capture wives (e.g., Chagnon, 1997).

Although females were less likely to have had the opportunity to benefit from kinship alliances once they migrated into the group of their mate, they would have nonetheless benefited from some level of social and emotional support from other adults. Social support results in improved personal and social stability and is associated with improved health and developmental outcomes for children (e.g., Flinn & England, 1995; Taylor et al., 2000). One likely source of this support was other females who had also immigrated into the community. Because these females were often unrelated or distantly related, the basis of female–female relationships was more likely to have been reciprocal altruism than kinship (Geary, 2002b). Kinship would of course still apply to mother–child relationships, and it is possible that the proximate mechanisms related to female friendships evolved, in part, from the affective systems that support mother–child relationships (MacDonald, 1992; Taylor et al., 2000, 2002). Either way, sex differences in the pattern of social dynamics (e.g., larger groups vs. dyads) and in the nature of same-sex relationships are predicted and discussed below.

### *Cost-benefit analysis*

Table 1 shows our proposal regarding the ultimate selection pressures and proximate selected forms that follow from male philopatry and male–male coalitional competition. Many of these traits, such as social dominance and resource control, also influence female choice of mating partners (Betzig, 1989; Hatfield & Sprecher, 1995). The focus here is specifically on the males' social behavior, because of the earlier noted lack of a clear theoretical foundation for understanding this behavior and why it differs from that of girls.

Although not theoretically driven, decades of empirical research have confirmed that the social affiliation, motivational dispositions, and expectations (e.g., of friends) differ comparing boys and girls, and men and women (Maccoby, 1998; Markovits, Benenson, & Dolenszky, 2001; Parker & Asher, 1993; Strayer & Strayer, 1976). Consistent with an evolutionary history of coalitional competition, boys organize themselves into much larger social groups than do girls (Eder & Hallinan, 1978; Lever, 1978; Omark, Omark, & Edelman, 1975; Waldrop & Halverson, 1975), and tend to engage in between-group competition once two or more such groups are formed (Lever, 1978; Sherif et al., 1961). Within each group, boys form dominance hierarchies (Maccoby, 1988; Omark et al., 1975), and show within-group role differentiation and specialization (e.g., in baseball, there is a pitcher, catcher, and so forth) when engaged in group-level competition (Lever, 1978).

Girls, in contrast, are much more likely to form dyads (Eder & Hallinan, 1978), at least after the preschool years (Benenson, Apostoleris, & Parnass, 1997). In the context of these dyadic relationships, girls in comparison to boys show high levels of emotional support, intimate exchanges (e.g., talking about their problems), and provide more help and guidance in solving social and other problems (Maccoby, 1990; Rose & Asher, 1999; Savin-Williams, 1987). Parker and Asher (1993) found that girls are also better at conflict resolution than boys but, at the same time, girls are more sensitive to personal slights on the part of their best friend and respond with more

Table 1  
 Predicted social dynamics and proximate supporting mechanisms of boys and men

Ultimate selection pressures	Proximate selected forms
<i>Group-level dynamics</i>	
1. Male–male competition for: <ul style="list-style-type: none"> <li>A. Control of local ecology and resources contained therein</li> <li>B. Control of reproductive dynamics</li> </ul>	<ul style="list-style-type: none"> <li>1. Coalition formation:               <ul style="list-style-type: none"> <li>A. Warfare over control of ecologies (e.g., land) and reproductive opportunity (e.g., raiding)</li> <li>B. Hunting for individual survival and provisioning of kin and family</li> <li>C. Protection of kin and family from other male coalitions</li> </ul> </li> <li>2. Intragroup dynamics               <ul style="list-style-type: none"> <li>A. Dominance hierarchy to facilitate coordinated activity</li> <li>B. Low threshold to form emotional and social bonds with group members, to facilitate group size</li> <li>C. Role specialization and differentiation</li> <li>D. Shared goals and attentional, behavioral focus on ecological problems (e.g., building a fort) or group competition</li> </ul> </li> </ul>
<i>Individual-level dynamics</i>	
1. Male–male competition for: <ul style="list-style-type: none"> <li>A. Dominance and influence within the coalition</li> </ul>	<ul style="list-style-type: none"> <li>1. Focus on dominance indicators:               <ul style="list-style-type: none"> <li>A. Physical: size, musculature, skill</li> <li>B. Social and cognitive: leadership and other competencies (e.g., tracking as related to hunting) that facilitate group performance</li> <li>C. Emotional: aggression, lack of fear</li> </ul> </li> <li>2. Individual relationships:               <ul style="list-style-type: none"> <li>A. Easily formed with shared activities, especially cooperative competition</li> <li>B. Formed more strongly among individuals of similar status (to facilitate greater reciprocity)</li> <li>C. Dominance contests are constrained</li> <li>D. Tolerance of interpersonal conflict (necessary for dominance contests while maintaining coalition)</li> </ul> </li> </ul>

initial and lingering negative affect (e.g., sadness, anger) than do boys (Whitesell & Harter, 1996). The evidence is not conclusive but does suggest that close relationships, as well as more casual relationships, among girls and women are more likely to permanently dissolve as a result of conflict, betrayal, and other stressors on the relationship (Lever, 1978; Wright, 1982). There is also evidence to suggest that girls and women are more sensitive to any inequalities in their relationships and inequalities among females in general, both in terms of material resources and social status (Ahlgren & Johnson, 1979; Eder, 1985; Winstead, 1986).

The pattern suggests that in comparison to boys and men, girls and women show greater interpersonal engagement and knowledge about the significant other in dyadic relationships (Markovits et al., 2001). They are more sensitive to the social-emotional cues of the dyadic partner (Buck, Savin, Miller, & Caul, 1972) and work harder to minimize any inequalities in the relationship (Winstead, 1986). Girls and women invest more in conflict resolution (Parker & Asher, 1993), presumably because this conflict results in greater emotional distress than it does in boys and men (Whitesell & Harter, 1996). If they are unable to resolve the conflict, a permanent disruption of the relationship appears to be more common in girls and women than in boys and men (Wright, 1982). Our proposal is that this pattern in girls and women's relationships is the consequence of social and emotional mechanisms that evolved to support friendships among non-kin. These mechanisms should result in greater monitoring of the give-and-take of the relationship and a lower threshold for dissolving the relationship when strict reciprocity is not achieved (Geary, 2002b; Trivers, 1971). This does not mean that boys and men are not reciprocal in many of their relationships, only that girls and women are predicted to be less tolerant of non-reciprocal relationships and that the maintenance of any such relationship is predicted to be more dependent on equalitarian reciprocity (see Fig. 2).

As we noted earlier, there is often an implicit assumption that the relationship style that emerges among girls is somehow preferable to the style that emerges among boys. Corollaries to this assumption can be stated as two questions: Why

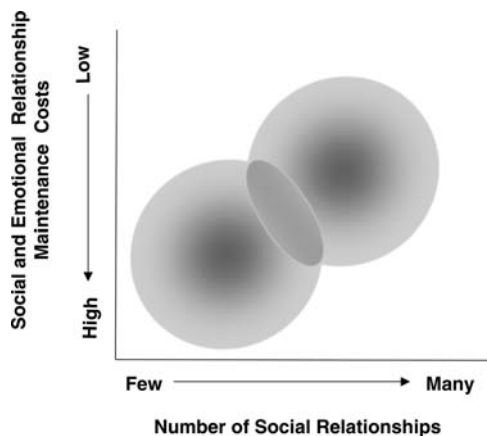


Fig. 2. Sex differences in the typical form of same-sex social relationships can be understood in terms of cost-benefit trade-offs. The bottom, leftmost section represents the styles that are common among girls and women. These relationships involve high levels of intimacy, personal disclosure, and interpersonal support, which in turn constrain the number of such relationships. The right, uppermost section represents the styles that are common among boys and men, that is, large coalitions that can only be achieved with the cost of less investment in individual relationships with other members of the coalition. These relationships are predicted to be based on less time-intensive mechanisms for their development and maintenance, in comparison to relationships among dyads of girls and women.

don't boys behave like girls? What might be done to change the tendency toward physical aggression and social dominance common in boys' social behavior? The answers are readily provided by our evolutionary model, but require a cost-benefit analysis to be fully appreciated. The basic cost-benefit trade-offs are shown in Fig. 2. The *x*-axis represents the size of social groups, and the *y*-axis represents the costs of maintaining one form of relationship or another and the associated constraints placed on group size. Table 2 outlines the costs and benefits of each social style.

The predicted relationship style of girls and women is represented by the lower left most area of Fig. 2. The emphasis on intimacy, emotional support, and an ethos of strict reciprocity (i.e., equality) in the interpersonal dynamic would appear to follow from social and affective mechanisms based on reciprocal altruism (Geary, 2002b), and possibly affective mechanisms that support relationships with children (MacDonald, 1992; Taylor et al., 2000). The principle benefit is a core set of relationships that appear to enable girls and women to maintain social, emotional, and interpersonal stability, as well as providing support during times of interpersonal conflict

Table 2  
Cost-benefit analysis of social styles

Defining features	Costs and benefits
<i>Boys and men</i>	
Emphasis on male–male competition and coalitions	Benefits: A. Control of local ecology and reproductive dynamics B. Larger groups C. Stable, cooperative, well-functioning, competitive coalitions D. Lower threshold to form cooperative social relationships with other in-group males E. Greater tolerance for interpersonal conflict
Evolutionary mechanisms: male philopatry and kin selection	
	Costs: A. Constraints on developing interpersonal intimacy B. Increased exposure to risk
<i>Girls and women</i>	
Emphasis on dyadic intimacy, emotional support, ethos of equality	Benefits: A. Maintenance of social, emotional, and dyadic interpersonal stability B. Increased interpersonal intimacy C. Support during times of interpersonal conflict
Evolutionary mechanism: reciprocal altruism	
	Costs: A. Constraints on possible number of relationships and, therefore the ability to form large, well-functioning competitive coalitions (fewer relationships = smaller groups) – High time investment per relationship – Requires constant availability for social support B. Risk of betrayal/vulnerability to social manipulation and relational aggression because of disclosure of personal information C. Lower tolerance for inequality in dyadic relationships

(Belle, 1987; Taylor et al., 2000). At the same time, the high level of investment of time, disclosure of personal information, and near constant availability for social support place severe constraints on the possible number of these relationships. Further, the level of personal disclosure common in these relationships can leave the girl or woman vulnerable to social manipulation and other forms of relational aggression by other girls or women (Bond et al., 2001; Crick et al., 1999; Rose & Asher, 1999). In other words, the benefits of interpersonal intimacy come with costs, specifically, limits on the number of these relationships and the risk of betrayal.

The cost-benefit trade-offs associated with interpersonal intimacy do not mean that boys and men do not form close, interpersonal relationships, they typically do (Parker & Asher, 1993). What it does mean is that the cost of maintaining the same style of interpersonal relationship found in dyads of girls and women places severe constraints on the ability of boys and men to form large, well-functioning and competitive coalitions (Geary & Flinn, 2002). The selective advantage of being part of a competitive coalition and the advantages associated with coalition size create a social ecology in which cooperative relationships among males are crucial. The balance of maintaining a large coalition and maintaining relationships with other boys and men in the coalition results in the prediction that the social and emotional mechanisms that support the formation and maintenance boys' and men's relationships must be lower cost (see Table 1) than those that support the dyadic relationships among girls and women (Geary & Flinn, 2002).

The upper rightmost section of Fig. 2 represents the cost-benefit trade-offs and predicted social dynamic among boys and men. This does not mean that males cannot have intense emotional bonds with other males or that males are inherently less cooperative than females. Rather, the mechanisms that facilitate the development and maintenance of such bonds cannot be as time-intensive as those found in girls and women. Boys and men are predicted to and do exhibit a lower threshold for forming cooperative social relationships with other boys and men (Eder & Hallinan, 1978), and in comparison to girls and women, the relationships of boys and men are predicted to be and are more readily maintainable (e.g., with less time-intensive disclosure), and evince a greater tolerance for interpersonal conflict (Whitesell & Harter, 1996; Wright, 1982). Tolerance for conflict is necessary to maintain the coalition and at the same time compete for dominance within the coalition. Dominance striving must, at the same time, be balanced against the cost of potentially losing the coalitional support of other boys and men, and thus social and psychological mechanisms that restrict dominance-related differentials between members of the same coalition are predicted to evolve, as cogently argued by Boehm (1993, 2000) (see also Hawley, 1999).

## **Boys social development**

In the sections above and in Table 1, we provide many evolutionary predictions regarding boys' social development. Unfortunately, the nuances of many of these predictions have not been systematically addressed in the existing literature, nor

has the existing literature been systematically interpreted in terms of sexual selection, with a few recent exceptions (Pellegrini & Long, 2003). Our goals are to describe how much of the existing literature is consistent with our evolutionary predictions. Through this we hope to provide a deeper understanding of the social and motivational dispositions of boys, and why the behavior of boys and girls differs.

### *Developmental goals and predictions*

It is often argued that the function of play and other social activities during childhood is to practice and refine the social, behavioral, and physical competencies that will contribute to survival and reproductive options in adulthood (Fagen, 1981; Groos, 1898; Smith, 1982), as well as to negotiate demands during the developmental period (Bjorklund, 1997; Bjorklund & Pellegrini, 2002; Bogin, 1997). These hypotheses are, however, difficult to evaluate, because it is difficult to restrict play without complete social isolation; social isolation results in a myriad of deficits, including abnormal play patterns (Pellis, Field, Smith, & Pellis, 1997). Nonetheless, our working assumption is that social play serves as both a means to practice and refine later sociocompetitive competencies and to meet more immediate needs (e.g., relationships with peers). The argument that play contributes to survival and reproductive competencies in adulthood is supported by the relation between social complexity, brain size, and length of the developmental period in primates and some other species (Dunbar & Bever, 1998; Joffe, 1997). In any case, given the risk of death before reproducing, a long developmental period should only evolve when at least some developmental activities result in reproductive benefits in adulthood (Alexander, 1987).

To practice and refine reproductive competencies, boys must per force be inherently biased to recreate the social dynamics that defined male intrasexual competition during human evolution. This prediction melds well with theory in behavior genetics (Scarr & McCarthy, 1983) and evolutionary psychology (Bjorklund & Pellegrini, 2002; Caporael, 1997; Geary, 2002a; Geary & Bjorklund, 2000), and with the empirical confirmation that children create their own social dynamics (Harris, 1995; Maccoby, 1988). In keeping with the social dynamics listed in Table 1, we propose that the tendency of boys to form large social coalitions and form a dominance hierarchy within these coalitions, as mentioned above and elaborated below, reflects an evolved motivational disposition associated with coalitionary male–male competition. In addition to influencing resource distribution, as is found in other species (e.g., Goodall, 1986), we predict that a dominance hierarchy is also necessary for effective coalitional competition. In this view, boys are predicted to form these coalitions and then engage in group-level competitive and other activities (e.g., play hunting).

### *Boys' social activities*

#### *Segregation*

In every culture in which it has been systematically studied, it has been found that boys and girls segregate into same-sex groups and engage in different forms of play and social behavior in these groups (La Freniere et al., 1984; Maccoby & Jacklin,

1987; Strayer & Santos, 1996; Turner & Gervai, 1995; Whiting & Edwards, 1988). The cross-cultural universality and the research indicating that the segregation is not the result of adult directives (see Maccoby, 1998) support the position that much of children's behavior is self-initiated. The end result is that girls and boys spend much of their childhood in distinct peer cultures (Harris, 1995; Maccoby, 1988). Although the sex differences that emerge in peer groups are often adapted to the context of the wider culture (e.g., play fighting with clubs, or not; see Chagnon, 1997), they are also consistent with biases that can be understood in terms of past evolutionary pressures.

In other words, the phenotypic expression of developmental activities reflects a mix of inherit biases and cultural influences. As an example, in cultures or subcultures in which male aggression is necessary to secure resources, boys' games often reflect more physical aggression compared with cultures in which resources can be attained by other means (Horowitz, 2001; Wilson & Daly, 1985). Parents encourage boys' physical aggression in these games, but parents will suppress the same-level of aggression in other contexts (Geary, 1998). In adulthood, male–male competition is also expressed differently in different contexts, but the motivation for hierarchical dominance and the tendency to form coalitional networks remain. In Western culture, an index of hierarchical control is socio-economic status (SES), but in many traditional societies dominance is often achieved through physical means (Chagnon, 1988).

### *Coalition formation*

*Function.* As noted in Table 1 and in keeping with the pattern of coalitional behavior in other species (e.g., Packer et al., 1991; Wrangham & Peterson, 1996), the function of human coalitional behavior appears to be control of territory and biological resources (e.g., prey species) within the territory (Kaplan et al., 2000; Horowitz, 2001). As with other species in which male coalitions form (Wrangham, 1999), the coalitional activities of men in traditional societies are also focused on control of reproductive and social dynamics (Chagnon, 1988).

*Development.* Studies of children's social preferences confirm the prediction that boys will, of their own initiative, form large same-sex groups, and engage in coalitional competition once these groups are formed. Although there are no sex differences in the amount of time spent in dyadic interactions during the preschool years (Benenson et al., 1997), boys begin to show a preference for group-level activities over dyadic activities as early as three years of age (Benenson, 1993), and show a strong bias against members of competing groups by five years of age (Yee & Brown, 1992). In a comprehensive study of spontaneous play, Lever (1978) found that 10- and 11-year-old boys participated in group-level competitive activities, such as football, three times as frequently as did girls. In addition, boys' spontaneous social play involved larger groups, on average, than did girls' social play and involved greater role differentiation within these groups. Many other scientists have reported similar sex differences in social play (Benenson et al., 1997; Eder & Hallinan, 1978;

Sandberg & Meyer-Bahlburg, 1994; Sutton-Smith, Rosenberg, & Morgan, 1963; Waldrop & Halverson, 1975).

Related studies are suggestive but not definitive with respect to the prediction that boys and men will have a low threshold for bonding with other in-group males (Geary & Flinn, 2002). The development and maintenance of boys' friendships or least coalitional alliances is often achieved simply through shared activities and often in social contexts in which coordinated group behavior is needed to achieve mutual goals (e.g., Savin-Williams, 1987; Sherif et al., 1961). In comparison to groups of girls, groups of boys show a greater willingness to incorporate additional boys (or athletic girls) into the group during competitive games (Rogers, Hennigan, Bowman, & Miller, 1984), and even in contexts that are not immediately competitive (Eder & Hallinan, 1978). The pattern is clearly consistent with the cross-species relation between coalition size and competitiveness (Wrangham, 1999), and in keeping with the prediction that boys (and men) have an implicit understanding of this relation and have a correspondingly low threshold for forming alliances with many other boys, and especially in situations of group-level competition (Sherif et al., 1961).

Savin-Williams' (1987) ethological study of adolescent social behavior is consistent with the prediction that the formation of a within-coalition dominance hierarchy facilitates the effectiveness of the coalition. Consistent with other studies (e.g., Pellegrini & Bartini, 2001), Savin-Williams found a pattern of heightened physical aggression and conflict when groups of 12- to 16-year-old boys were first assigned to summer camp cabins. Over the course of several weeks, a dominance hierarchy was formed in each cabin and friendships among most of the boys in the cabin were formed. Once the hierarchy was in place, conflict was minimal and coalitional activities, such as sports competition with boys from other cabins, increased in frequency. By the end of summer camp, dominant boys were almost always engaged with other in-group members and spent most of their free time directing the group in competitive athletic activities. In other words, dominant boys actively and successfully controlled group activities, with the implicit approval of other group members and often to the benefit of the competitive abilities of the coalition.

Related ethological studies, also reported by Savin-Williams (1987), indicate that by late adolescence boys' group-level games are characterized by greater focus and organization, with fewer within-group negative criticisms and more encouragement than is found with younger boys. Relationships among in-group boys become more cooperative and supportive, once the hierarchy is established. During their dominance-related encounters with in-group members, older boys use physical assertion less frequently and recognition more frequently than do their younger peers. By late adolescence, boys' competencies regarding the cooperation and social support needed to function effectively as a competitive coalition (e.g., team sports) are very sophisticated.

Although not conclusive, these studies are consistent with the prediction that one function of boys' developmental activities is to refine the social competencies needed to form competitive coalitions in adulthood. Many of these developmental activities, such as team sports, also mirror, and thus may provide practice for, specific behavioral skills associated with primitive warfare, such as throwing and tracking the trajectory of projectiles (Geary, 1995). Moreover, boys and men show increased cortisol

and testosterone responses with the formation of same-sex coalitions during group-level competition, which is the expected endocrine reaction associated with an evolved fight response when the fight occurs in the context of group-level competition (Dabbs & Dabbs, 2000; Wagner, Flinn, & England, 2002).

*Sex differences.* Sex differences in child-initiated social behaviors and preferences begin to emerge as early as 18 months of age (e.g., Benenson, 1993; La Freniere et al., 1984; Ruble & Martin, 1998). The magnitude of many of these sex differences increases by the end of the preschool years and others emerge or change in form. Relevant to the current discussion is the finding that, by the elementary school years, boys spend considerably more time in coalitional activities than girls, and girls spend more time in dyadic activities, on average, than boys (Benenson et al., 1997), as noted above. These differences have been found in multiple contexts and across generations (Lever, 1978; Sandberg & Meyer-Bahlburg, 1994; Savin-Williams, 1987; Sutton-Smith et al., 1963), and may be influenced by prenatal exposure to androgens (Benenbaum & Snyder, 1995). Moreover, in relation to boys' groups, girls' groups include fewer individuals, less in-group specialization, and less effective coordination of group activities (Lever, 1978). In fact, as described earlier, most girls prefer dyadic social activities to group-level activities (Eder & Hallinan, 1978; Markovits et al., 2001).

In the earlier described summer camp study, Savin-Williams (1987) found girls' dominance hierarchies and coalitional activities decreased in stability across time, in contrast to the increasing stability of boys' coalitions. By the end of summer camp, most of the girls' groups were on the verge of splintering or had already split into "status cliques based on popularity, beauty, athletics, and sociability" (Savin-Williams, 1987, p. 124). In some cases, dominant girls disengaged from the cabin-group and spent most of their free time with a friend, consistent with the finding that girls' groups are often comprised of dyads (Eder & Hallinan, 1978; Lever, 1978).

These sex differences are consistent with the prediction that coalitional activity has covaried with survival and reproductive options more strongly for males than for females during human evolution (Wrangham & Peterson, 1996; Keeley, 1996). The differences also appear to be consistent with the predicted social biases that would have evolved with male-biased philopatry and female migration into the group of their mate. In this view, girls' dyadic activities enable them to control social dynamics with peers (Crick et al., 1999), and to refine the social skills needed to form relationships with unrelated women in adulthood, as described earlier. More precisely, we are assuming that the relationship skills that develop during childhood, such as conflict resolution (Parker & Asher, 1993) and relational shunning (Eder, 1985), enable girls to slowly develop the social competencies that will enable them to maintain at least one stable relationship with another women in adulthood, but also to manipulate wider social relationships in ways that will benefit them and their children (Geary, 2002a).

### *One-on-one dominance*

*Function.* In an influential article, Smith (1982) proposed that the evolutionary function of play fighting was to practice and refine dominance-related competencies

that will be used during intrasexual competition in adulthood. The presented evidence included the finding that play fighting during juvenility is more common in species with intense intrasexual competition than in other species. When male–male competition is more common, males engage in more play fighting than females, and when female–female competition is more common females engage in more play fighting than males. Play fighting may also serve as an indicator of the status of relationships—reaffirmation of friendships and knowledge/establishment of the dominance hierarchy.

One-on-one male–male competition in humans is, however, considerably more plastic and dynamic than male–male fighting in other species and need not involve a physical component (Geary, 1998). As a result, studies of specific fighting behaviors may be less informative for humans than for other species, although Boulton (1996) did find that some behavioral components (e.g., type of hitting) were the same, though muted, in boys' play fighting as in real fights. Boulton and Smith (1992) concluded that boys' play fighting also contained many of the general features (e.g., switching offensive and defensive roles when wrestling) of real fighting, if not all of the specific behaviors, and thus could provide practice for later dominance-related social strategies. Another possibility, as with rats, is that play fighting functions to determine social dominance in the current peer group, rather than practice for specific fighting behaviors (Pellegrini & Smith, 1998; Smith & Hunter, 1992).

Achievement of dominance in the peer group might in fact have both immediate and longer-term effects. If during human evolutionary history males tended to stay in their social group throughout their lifespan, as would typically occur with male philopatry, then dominance relations in childhood and adolescence would continue to some degree into adulthood. The dominance hierarchy would, of course, remain mutable, but the coalition would be considerably more stable and internally organized (e.g., in terms of role specialization) than would be possible without play fighting and coalitional games during childhood and adolescence. In keeping with this proposal is the finding that the effect of dominance rank is accentuated when individuals are familiar with each other (Hawley & Little, 1999). In other words, we are proposing that play fighting and coalitional games function to develop in-group dominance relationships and coalitional coherence before the group of related boys matures to the point of actual coalitional competition. These activities may also improve specific behavioral (e.g., fighting) and other (e.g., pain tolerance) competencies but the primary function may be social (Pellegrini & Smith, 1998), that is, mechanisms to bond in-group males together and to form a role-specialized competitive coalition.

*Development.* Although the earliest manifestation of dominance-related behavior in boys is physical contests over control of desired objects (Strayer & Strayer, 1976), one of the more common manifestations is rough-and-tumble play. This involves playful (e.g., as indicated by facial expressions) hitting, pushing, shoving, and so forth (Smith & Hunter, 1992). Boys' rough-and-tumble play emerges at about three years of age (Maccoby, 1988), is found in every culture in which it has been studied (Charlesworth & Dzur, 1987; DiPietro, 1981; Maccoby, 1988), and contributes to the

formation of dominance hierarchies in boys' groups (Omark et al., 1975; Strayer & Strayer, 1976). Rough-and-tumble play peaks between the ages of 8 and 10 years, at which time boys spend about 10% of their free time in these activities (Pellegrini & Smith, 1998). In adolescence, this type of play intensifies, and the line between play and outright physical aggression begins to blur.

As with other species, there is recent evidence to suggest that the relation between physical assertion and social dominance becomes more obvious and serious in late childhood and early adolescence. In a study of Western children, Pellegrini and Bartini (2001) found that between the ages of 10 and 12 years, bullying among boys increased at the beginning of the school year and then decreased later in the school year, suggesting that a dominance hierarchy had been established. Unlike younger boys for whom physical aggression is often associated with unpopularity and social rejection (Newcomb, Bukowski, & Pattee, 1993), physical dominance in adolescent boys may contribute to the achievement of social dominance, as defined by peers and teachers. In comparison to less assertive boys, these boys date more frequently and are rated as more attractive by girls (Pellegrini & Bartini, 2001; Pellegrini & Long, 2003). Pellegrini and Bartini's findings are consistent with a broader, cross-cultural relationship between cultural success—achieved physically, politically, or economically—and men's attractiveness as mates and their reproductive opportunities (Chagnon, 1988; Geary, 1998; Pérusse, 1993).

However, physical aggression is not the only way to become socially dominant, as we noted earlier. Prosocial strategies (e.g., offering to help) also serve to control resources and result in higher status (Hawley, 1999), and in some contexts the use of physical aggression as a social strategy is not always associated with social dominance, in childhood (Strayer & Strayer, 1976) or in adulthood (Keeley, 1996). At the same time, physical dominance and skill as a warrior are clearly related to social status among men in many traditional societies (Chagnon, 1988; Hassrick, 1964). Across cultures, the use of physical assertion and aggression to obtain within-coalition dominance and in associated games during development is most common in contexts with endemic raiding and warfare, that is, contexts in which between-group coalitional competition is common and deadly (see Geary, 1998). Contrary to popular beliefs, coalitional competition is endemic to most hunter-gatherer, horticultural, and agricultural societies (Ember, 1978; Keeley, 1996), but occurs less frequently in large-scale, industrialized societies. It is in segments of these latter societies in which parents often suppress the aggressive behavior of boys (Low, 1989) and redirect it toward other means of competing (e.g., through education), although suppression of competitive and aggressive behavior can also occur in traditional societies that are not currently experiencing intergroup conflict.

*Sex differences.* In keeping with Taylor et al.'s (2000) proposal, rough-and-tumble and other forms of physical play, as well as physical aggression, are much more common among boys than among girls (Charlesworth & Dzur, 1987; DiPietro, 1981; Maccoby, 1988; Strayer & Strayer, 1976). Preschool boys in the United States engage in playful physical assaults and other forms of rough-and-tumble play 3–6 times more frequently than do same-age girls (DiPietro, 1981), a sex difference that con-

tinues through childhood and adolescence (Pellegrini & Bartini, 2001; Pellegrini & Long, 2003; Savin-Williams, 1987). The same pattern is found in other industrial societies and in traditional societies in which it has been studied, although the magnitude of the sex difference varies from one culture to the next (Eibl-Eibesfeldt, 1989; Whiting & Edwards, 1973, 1988).

Late adolescence and early adulthood is the period in the lifespan in which intrasexual competition is most intense, and sex differences in the frequency of serious physical assaults and deadly physical aggression accelerate during this time (Wilson & Daly, 1985). Male-on-male homicide in industrial and traditional cultures often results from dominance contests (e.g., status displays) or sexual rivalry, and as we noted earlier occurs between 30 and 40 times more frequently than does female-on-female homicide (Daly & Wilson, 1988). Male-on-male homicide can result as one male seeks to move up the in-group dominance hierarchy (Wilson & Daly, 1985) or in the context of coalitional conflict (Horowitz, 2001). The pattern of male-on-male physical aggression and the associated sex differences are exactly what is predicted for a species in which reproduction-related intrasexual competition has been more intense for males than for females (Darwin, 1871).

## **Conclusion**

A comprehensive understanding of the social styles of boys and men as contrasted with that of girls and women is not achievable with only social-evaluative comparisons (e.g., “demonic” males), which may simply be attempts to suppress or manipulate the behavior of one sex or the other (Geary, 1998; MacDonald, 1988). Rather, a scientific understanding of the specific social styles of the two sexes should be based on the assumption that they are different rather than one being somehow preferable to the other; preferable is subjective, as it depends on the self-interest of the evaluator. Sex differences in social styles can be understood in terms of ultimate selection pressures and the corresponding proximate forms. Across species, the reproductive dynamics that compose sexual selection define a broad class of ultimate selection pressure that typically varies for males and females (Darwin, 1871). One component is male–male competition over reproductive dynamics, and it is our proposal that this feature of sexual selection is the key to understanding boys’ social development and the ultimate selection pressures that shaped boys’ and men’s social styles.

Although the evidence is not yet conclusive, it is substantive: Human evolutionary history almost certainly involved intense and recurring patterns of male–male competition. Anthropological (Chagnon, 1988), archeological (Keeley, 1996), and population genetic (Underhill et al., 2001) studies, as well as patterns of conflict in extant human populations (Horowitz, 2001), all converge on the conclusion that there is a long evolutionary history of coalitional and one-on-one male–male competition in humans. The functions of developmental activities are currently debated (Pellis & Pellis, 1998), but likely include some combination of immediate (e.g., peer relationships) and longer-term benefits (Bjorklund & Pellegrini, 2002; Smith, 1982). Included

among the potential longer-term benefits is preparation for the survival and reproductive demands of adulthood, which includes preparation for intrasexual competition (Groos, 1898).

We propose that many of the aspects of boys' social behavior, such as "egoistically dominant" (Whiting & Edwards, 1988, p. 270), that are sometimes unfavorably compared to those of girls are a reflection of an evolutionary history of coalitional and one-on-one male–male competition (see also Wrangham & Peterson, 1996; Geary, 1998). One result is that boys appear to have an inherent motivational disposition to form large, competition-related social groups and to form dominance hierarchies within these groups. The activities involved in creating coalitions and dominance hierarchies result in many of the social behaviors of boys that are sometimes viewed unfavorably, at least in some cultural contexts. From an evolutionary perspective, however, boys show these biases because our male ancestors showed similar biases, which in turn provided them with a reproductive advantage over other males. Specifically, these developmental activities may enable males to form cohesive and competitive coalitions during childhood and adolescence and thus work out in-group dominance relations before more serious competition in adulthood.

At the same time, an evolutionary perspective does provide a different theoretical lens through which boys' behavior and social development can be viewed and understood, and a source for generating new hypotheses about boys' social development and associated sex differences. Among these are the predictions that (a) boys and men will show low thresholds for forming social bonds with other males (the social activities and psychological mechanisms are not well understood); (b) these bonds will be more readily formed in situations that involve group-level competition than in other stressful, non-social situations; (c) boys and men will show higher levels of cooperation and affiliative behaviors with more members of an in-group than will girls and women; (d) boys and men will show greater tolerance for in-group conflict than will girls and women; and, (e) boys' and men's competitive groups will show greater and more effective role differentiation (without coaching) than will girls' and women's competitive groups.

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