

## Original Article

### On the Evolution of Sport

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**Abstract:** Sports have received little attention from evolutionary biologists. I argue that sport began as a way for men to develop the skills needed in primitive hunting and warfare, then developed to act primarily as a lek where athletes display and male spectators evaluate the qualities of potential allies and rivals. This hypothesis predicts that (1) the most popular modern male sports require the skills needed for success in male-male physical competition and primitive hunting and warfare; (2) champion male athletes obtain high status and thereby reproductive opportunities in ways that parallel those gained by successful primitive hunters and warriors; (3) men pay closer attention than do women to male sports so they can evaluate potential allies and rivals; and (4) male sports became culturally more important when opportunities to evaluate potential allies and rivals declined as both the survival importance of hunting and the proportion of men who experience combat decreased. The characteristics of primitive and modern sports are more consistent with these predictions than those generated by intersexual sexual selection theories of sport.

**Keywords:** athletic competition, honest signaling, natural selection, sexual selection, sports, war

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### Introduction

Sport has received scant attention from evolutionary biologists. This is surprising for several reasons. First, sport's universality suggests that it has evolutionary origins (Brown, 1991). Second, athletic contests, especially those of boys and men, are important parts of the social fabric in modern societies (e.g., Bissinger, 1990; Guttmann, 2004a, 2004b). Third, more men than women of all ages play (Crespo, Keteyian, Heath, and Sempos, 1996; Eibl-Eibesfeldt, 1989; Lever, 1978; Stubbe, Boomsma, and De Geus, 2005) and avidly watch sports (e.g., Guttmann 1986; Dietz-Uhler, Harrick, End, and Jacquemotte, 2001). Fourth, complex organizations have developed, especially over the last 150 years (Guttmann, 1978, 2004b; Szymanski, 2006), to schedule, regulate, and advertise athletic competitions for all age groups. Fifth, athletic contests between rival teams of men are important social events, with crowds of over 100,000 spectators present at many contests.

Sixth, even though athletic contests are often simple (e.g., who can run 100m the fastest?), involve only few participants (e.g., eight men in the Olympic Games 100m final), and have no apparent direct biological purpose (e.g., how does winning a 100m race directly affect survivorship and reproductive success?) (Miller, 2000) they have, in some instances, affected large proportions of the world's population. For example, the global social and political significance of the 1936 Berlin (e.g., Baker, 1986; Schaap, 2007) and the 1960 Rome Olympics (Maraniss, 2008) have been subjected to analytical treatments. Last, champion male athletes achieve high status (e.g., Chase and Dummer, 1992; Földesi, 2004; Golden, 2008; Guttmann, 2004b; Sohi and Yusuff, 1987) and increased reproductive opportunities (e.g., Faurie, Pontier, and Raymond, 2004; Llaurens, Raymond, and Faurie, 2009) suggesting that selection may have been influential in molding the characteristics of male athletes and the sports they play.

These observations raise important questions about the role of sport in human nature: (1) How and why did sport begin? (2) Why are sports primarily a male phenomenon? (3) Why do champion male athletes in some sports often obtain higher status and more reproductive opportunities than do champions from other sports and endeavors? (4) What are the relative roles of intra- and intersexual selection in shaping sport's characteristics? (5) Why has sport attained such cultural importance in modern cultures?

#### *Sport defined*

Throughout, a sport is defined as an activity requiring direct physical competition with an opponent(s), has established procedures and rules, and defined criteria for determining victory (Poliakoff, 1987). Whether or not there is an immediate tangible reward (e.g., trophy, medal, or money) for victory is irrelevant because competitors have the immediate goal of winning the contest. What happens afterward does not change the nature of the contest. Sports like auto racing, horse racing, or sailing are not included in my discussions because (1) the outcomes of these contests are influenced by the quality of the conveyances involved and (2) my focus is on sports where outcomes are most often directly determined by physical prowess and thus most probably like ancient sports.

#### *Focus on male sports*

I focus on the evolution of male sport for several reasons. First, despite the recent rapid increase in participation by women (e.g., Shulman and Bowen, 2001), sport remains primarily a male endeavor (e.g., Guttmann, 1991, 2004b; McComb, 2004). Second, athletic success is primarily determined by physical prowess. Men typically outperform women in sports, especially those that require skills also useful in male-male physical competition and primitive hunting and warfare, because men, on average, are more aggressive, larger, faster, and stronger than women (Abe, Kearns, and Fukunaga, 2003; Archer, 2004, 2009; Cardinale and Stone, 2006; Chevront, Carter, Deruisseau, and Moffatt, 2005; Lassek and Gaulin, 2009; Mayhew and Salm, 1990; Miller, MacDougall, Tarnopolsky, and Sale, 1993; Seiler, DeKoning, and Foster, 2007). Last, men more often than women use direct physical competition (e.g., fighting) to achieve status and access to resources and reproductive opportunities (e.g., Buss, 2007; Dunbar and Barrett, 2009; Wrangham, 1999). The last two points are consistent with the hypotheses that the reproductive success of ancestral men

was likely correlated with their success in intrasexual contests and that the selection pressures for physical traits that increase the chances of success in direct physical competition have been stronger on men than on women (Puts, 2010). That female athletes, including professionals, are more likely to suffer athletic injuries, especially those associated with the mechanical stresses associated with running and jumping (Deitch, Starkey, Walters, and Moseley, 2006; Hewett, Myer, and Ford, 2006), is consistent with this hypothesis.

### **Cultural Hypotheses about the Evolution of Sport**

Ruminations about the origins and functions of sport have typically focused on its cultural components (e.g., Ashe, 1988; Carroll, 2000; Guttmann, 2004b; Huizinga, 1949; McComb, 2004; Roberts, Arth, and Bush, 1959; Sansone, 1988; Szymanski, 2006). Cultural hypotheses about sports are primarily descriptive, non-mutually exclusive, and fill several categories: non-utilitarian (e.g., Guttmann, 2004a; Huizinga, 1949), cultic (e.g., Brasch, 1970), ritualistic (e.g., Baker, 1982), Marxist (Guttmann, 2004a; Hoberman, 1992), and cathartic (Lenzi, Bianco, Milazzo, Placidi, Catrogiovani, and Becherini, 1997). Sansone's (1988) hypothesis that sport represents a ritual sacrifice of energy by those with the greatest amount of energy to sacrifice comes closest to the modern biological concept of an honest display of physical quality (cf. Hamilton and Zuk, 1982; Zahavi and Zahavi, 1975, 1997). Moreover, Sansone (1988) connected the ability to sacrifice energy with increased status and reproductive opportunities, anticipating Miller's (2000) and deBlock and Dewitte's (2009) ideas about the role of intersexual sexual selection in the evolution of sports.

Despite their potential relevance to a biological evolutionary theory of sport, cultural hypotheses are incomplete because they tend to focus on its proximate causes (cf. Tinbergen, 1963) and thus often fail to evaluate the effects of sports on the survival and reproductive success of athletes and spectators. In doing so, they discount the possible roles of natural and sexual selection in shaping the evolution of sport. This failure hinders our ability to develop a comprehensive understanding of the role of sport in human nature because it neglects its ultimate causes (cf. Tinbergen, 1963). There should be some connection between our behavioral traits and our survival and reproductive strategies (Williams, 1985) because natural and sexual selection provide the explanatory background for the traits of life (Alexander, 1979). Furthermore, widespread and persistent cultural phenomena, like sport, tend to persist because they benefit their practitioners (Lahti and Weinstein, 2005).

### *Hunting, warfare, and sport*

Despite their different foci, cultural hypotheses about the functions of sport conclude that sport likely had its origins as a way for men to develop and practice hunting skills (cf. Carroll, 2000). The relationship between hunting and sports that include chasing, hitting targets with projectiles, and stalking is obvious. Because primitive warfare used the same skills, some have argued that training for war is the source of all sport (e.g., Chick, Loy, and Miracle, 1997; Loy and Hesketh, 1995; Sipes, 1973).

While the connections between sports, hunting, and warfare seem clear, there are a few discrepancies. A satisfactory theory of sport should explain (1) why the cultural importance of sport increased at the same time the need for men to use sport to train for hunting and warfare decreased, (2) why men pay such close attention to athletic contests, and (3) the diversification of sports (Sansone, 1988).

### **Adaptive Hypotheses about the Evolution of Sports**

The characteristics of animal play suggest that sport likely originated as play. The play of juvenile mammals, including humans, often mimics behaviors (e.g., capturing prey, escaping from predators, fighting) needed for survival (Fagen, 1981). Human play behaviors also mimic those used in many sports (e.g., running, chasing competitors, throwing and intercepting projectiles). In nonhuman animals, play tends to occur during a sensitive period critical for the development of cerebellar synaptogenesis and the differentiation of fast- and slow-twitch muscle fibers (Byers and Walker, 1995). There may also be sensitive periods important for the development of social behaviors (Eimon and Morgan, 1989; Potegal and Eimon, 1989). In contrast to nonhuman play, human play may persist into old age.

The physical activity of play, especially the rough-and-tumble play (RNT) characteristic of males (DiPietro, 1981; Humphreys and Smith, 1987), may have important psychological as well as physical effects (Pellegrini and Smith, 1998). While RNT provides physical practice for fighting and hunting (Smith, 1982; Symons, 1978), it also simultaneously allows juveniles to assess the physical strength and skills of others (Smith, 1982; Paquette, 1994). Thus, RNT can function as a means to develop and maintain leadership and dominance within groups (Waters and Sroufe, 1983; Pellegrini and Smith, 1998). The assessment of others during RNT may also be achieved at low cost by observation. The functions of RNT parallel those hypothesized for sport below.

It is reasonable to seek a distinctly evolutionary explanation for sport because it is a human universal, exhibits sex differences in participation, performance, and observation, and commands the attention and resources of so many people, especially men. Strangely, many evolutionarily minded authors (e.g., Alexander, 1979; Barrett, Dunbar, and Lycett, 2002; Buss, 2007; Cartwright, 2008; Dunbar and Barrett, 2009; Geary, 2009; Low, 2000; Workman and Reader, 2008) have all but ignored developing an evolutionary explanation of sport. Puts (2010) examined the role of male contests in sexual selection in humans but did not discuss athletic competition as a form of male-male competition. Others (e.g., Geary, 2009) noted that the physical skills and psychological characteristics needed for success in team sports are similar to those required during cooperative hunting and warfare, but did not develop theories about the biological evolution of sport in any depth.

Miller (2000) and deBlock and Dewitte (2009), by arguing that modern sport primarily functions as a way for men to display their physical prowess and behavioral qualities to potential mates, emphasized the role of intersexual sexual selection in the evolution of sport. However, if sport evolved from a way for men to train for fighting, hunting, and warfare into an arena for female mate choice, then women should pay close attention to male athletic contests so they can evaluate the characteristics of potential

mates. However, this prediction is difficult to reconcile with the observation that men tend to be much more avid sports fans than women (Guttman, 1986; Dietz-Uhler, Harrick, End, and Jacquemotte, 2001). deBlock and Dewitte (2009) anticipated this problem and argued that sport may also provide men with opportunities to evaluate the qualities of potential allies and rivals, but they did not fully develop this idea.

My objective is to construct a Darwinian (Darwin, 1859, 1871) evolutionary explanation for sport. I hypothesize that, from its beginnings in play and then training for fighting, hunting, and warfare, sport evolved to provide men with arenas for intrasexual competition and a way to evaluate potential allies and rivals. I am not arguing that the behaviors and physical traits associated with athletic success and spectatorship are adaptations evolved for sport. Rather, they are the by-products of traits evolved in the context of male-male physical competition and primitive hunting and warfare (i.e., exaptations; Gould and Vrba, 1982). My hypothesis augments intersexual sexual selection hypotheses of sport (e.g., deBlock and Dewitte, 2009; Miller, 2000) and explains why men are more interested in sports than are women.

### **The Male Spectator Lek Hypothesis of the Evolution of Sport**

Sports originally provided males with important, but relatively low-cost, opportunities to (1) develop the physical skills (e.g., agility, endurance, eye-hand coordination, speed, strength) and behaviors (e.g., context appropriate aggressiveness, competitiveness, and cooperativeness) required for success during male-male competition and as hunters and warriors, and (2) evaluate the physical abilities and behavioral tendencies of potential allies and rivals so as to adaptively interact with them during future encounters.

Men have historically encouraged boys to play sports as a way to teach them the physical skills necessary for primitive hunting and warfare and inculcate in them the behaviors needed for group success (e.g., Ashe, 1988; Carroll, 2000; Cartledge, 2003; Guttman, 2004a, 2004b). These traits would also benefit them during physical contests over resources and mates. Athletic success also likely provided ancestral men with increased reproductive success through increased status in ways that parallel the increased status frequently obtained by “champion” hunters and warriors among modern hunter-gatherers and athletes throughout recorded history. Both intrasexual and intersexual sexual selection act synergistically, affecting the evolution of sport. Traits that lead to athletic success can become preferred by women during mate choice because they are honest indicators of mate quality (Zahavi, 1975; Puts, 2010). However, male traits associated with competing at and watching sports appear to be better designed for success at male-male competition than for attracting mates (cf. Puts, 2010).

I hypothesize that sport evolved to function like a non-human mating display lek (e.g., sage grouse, *Centrocercus urophasianus*), but with an important difference. In typical mating display leks, males congregate in areas that do not contain resources used by breeding females and perform courtship displays observed by females that either directly choose with whom they will mate, or copy the mate choice of others (Höglund and Alatalo, 1995). I hypothesize that athletic contests function as “leks” where male physical prowess

and the behaviors important in conflict and cooperation are displayed by athletes and evaluated primarily by male, not female, spectators. Male spectators can inexpensively learn the qualities of potential allies and rivals without having to pay the costs of direct competition. Moreover, athletic contests are like mating display leks that evolved via female preference. Females in lekking species prefer leks with large groups of males allowing them to quickly, relatively safely, and at low cost simultaneously evaluate the qualities of many potential mates (Höglund and Alatalo, 1995). In a similar way, the preferences of male spectators have driven the evolution of sport. Male preferences have determined contest rules, the scheduling of contests, and the physical and mental attributes showcased by different sports (e.g., Guttman, 2004b; Miller, 2000) so that male spectators can quickly, relatively safely, and at low cost evaluate the qualities of potential allies and rivals. According to the male spectator lek hypothesis, the primary force in the evolution of sport was intrasexual selection driven by the (1) demands of male-male physical competition and (2) need for men to be able to evaluate the quality of potential allies and rivals.

The need for men to evaluate the fighting ability and warrior potential, rather than hunting ability, of other men may have been the most important selection pressure shaping the evolution of sport because the immediate costs of fighting a superior competitor or allying with an inferior warrior (e.g., death) are far greater than the costs of allying with an inferior hunter (e.g., loss of a meal). The relatively high male mortality rates of modern hunter-gatherers from warfare (e.g., Gurven and Kaplan, 2007) are consistent with the hypothesis that men who were able to accurately evaluate the warrior potential of other men had an advantage over those who could not. Bowles (2009) demonstrated that the fitness consequences of primitive warfare were sufficient enough to affect the evolution of human social behaviors, suggesting that intrasexual selection was more important than intersexual selection in molding the evolution of sport.

#### *The adaptive nature of modern sports*

Modern sports are highly derived and their origin in Victorian England is very recent (Guttman, 2004a,b). Therefore, some aspects of modern sports, such as professionalism, national and international competitions, and the diversity of sports are likely consequences of exaptations first evolved in the context of male-male competition and primitive hunting and warfare. Nevertheless, participation in sports by modern athletes may still be adaptive because it provides them with opportunities to develop and display traits that remain important in both intrasexual competition and mate choice. In this sense, modern individual sports behavior is an adaptive exaptation (*sensu* Laland and Brown, 2002, Fig. 4.1).

The arenas of ecological, social, and sexual competition between professional athletes and other men rarely overlap. Therefore, the intense interest of many men in the exploits of professional athletes and teams may be a by-product of adaptations evolved in the context of using sport to evaluate local potential allies and rivals rather than a currently adaptive behavior (cf. Winegard and Deaner, 2010). Winegard and Deaner (2010) argued that modern sport fandom is a by-product of the evolution of adaptations that would have facilitated coalition formation, especially by men, in the context of the frequent small-scale

warfare common for most of human history (e.g., Gat, 2006; Keeley, 1996). Nevertheless, closely observing local contests may be adaptive for male spectators if they use the athletic performances of local competitors to modify their future behavioral interactions with them.

*The assumption and predictions of the male spectator lek hypothesis of sport*

The validity of the male spectator lek hypothesis can be evaluated by testing its assumption and predictions. If men have been subjected to a long history of natural and sexual selection in the contexts of male-male competition, hunting, warfare, and sports, we expect them to have some characteristics and not others (Williams, 1985). Examination of sport will reveal whether it has the predicted characters or not.

The male spectator lek hypothesis assumes that success in sport is an honest display of male quality and predicts: (1) male sports develop the physical skills and behaviors required for success in male-male physical competition, primitive hunting and warfare; (2) the most popular male spectator sports are those that most accurately display traits required for success in these endeavors; (3) male athletic success leads to increased status and reproductive opportunities; (4) men should be more avid sports fans than women; and (5) sport increased in cultural importance, and the status of champion athletes increased, when the opportunities for men to evaluate the qualities of potential allies and rivals during hunting and warfare declined as the role of hunting and the proportion of men in a population who participated in warfare decreased.

**Success in Sport is an Honest Indicator of Male Quality**

Athletic success is analogous to natural selection. Just as individuals that are the best adapted to local conditions tend to out-reproduce their competitors, only the best athletes transition from one level of competition up to the next (i.e., make it to the “next generation”). Elite athletes capable of competing in the Olympics or at the professional level generally represent less than 1% of the male population (e.g., Leonard, 1996).

If sport evolved to function as a way for men to evaluate the qualities of potential allies and rivals, then selection should have favored the expression by male athletes of the traits that historically led to success in male-male physical competition and primitive hunting and warfare. Some of the physiological traits (reviewed in Lippi, Longo, and Maffulli, 2009) that contribute to athletic success, including testosterone levels (e.g., Harris, Vernon, and Boomsma, 1998; Hoekstra, Bartels, and Boomsma, 2006), are highly heritable, making them susceptible to selection.

There probably has been a lessening, especially in the recent past, in the strength of the selection pressures favoring the physical traits that led to success in male-male physical competition and primitive hunting and warfare because (1) non-hunter-gatherer economies (e.g., pastoral, agricultural, industrial) produce various ways for men to achieve status that do not depend on physical prowess, (2) losing an athletic contest typically does not have as dire consequences on survival and reproduction as does failure in hunting and, more especially, warfare, and (3) because of the development of weapons that do not require exceptional strength to use effectively (Crosby, 2002; van Creveld, 1989). A long history of strong intrasexual selection on men favoring the physical traits that led to success in male-

male physical competition and primitive hunting and warfare, and the covariation between male success at these endeavors and reproductive success for most of human history (e.g., Betzig 1986, Chagnon 1988, Smith 2004), should result in less variation in male than female athletic ability. Consistent with this prediction, there is less variation in the competitive performance of male than female runners at the high school, collegiate, and professional levels in the USA (Deaner, 2006).

### **Male Sports Display the Skills Required for Success at Fighting and Primitive Hunting and Warfare**

Marge: “Tell me, why is it when men play, they always play at killing each other?”

A. Minghella, scriptwriter, “The Talented Mr. Ripley” (1999)

If male athletic competition developed from practicing the skills required by male-male physical competition and primitive hunting and warfare, then we would expect the same skills to dominate male play behavior and sports (cf. Williams 1985) and be those most “valued” by male spectators (Miller 2000).

Cross-culturally, the play of boys differs from that of girls (Geary, 2009) and is characterized by its physicality, face-to-face confrontations, adherence to complex rules, and cooperative team play with defined roles for team members (Lever, 1978). Boys play hunting and war games more often than do girls in a variety of societies (e.g., Ashe, 1988; Chagnon, 1997; Eibl-Eibesfeldt, 1989; Goldstein, 1995; Hoffman, 1890; Loy and Hesketh, 1995). Boys 6-10 years old in contemporary USA play games that require speed, strength, and teamwork more often than do same-aged girls (Sandberg and Meyer-Bahlburg, 1994). Rough-and-tumble play is more common among boys than girls (Boulton and Smith, 1992; DiPietro, 1981; Humphreys and Smith, 1987; Pellegrini, 1995). Some of the physical and social skills learned during physical games and team sports are also required for success in cooperative hunting and warfare (Geary, 2009; van Vugt, DeCremer, and Janssen, 2007; Yuki and Yokata, 2009). During athletic play, boys also learn how their skills compare with those of potential allies and rivals (e.g., Boulton and Smith, 1992). These observations are consistent with the hypothesis that men use the athletic performances of others to evaluate the abilities of potential allies and rivals.

Upper body strength is especially important in hand-to-hand fighting, combat sports (e.g., boxing, wrestling), and sports involving projectiles. The chest pounding duels of Yanomamö men display upper body strength and advertise fighting ability (Chagnon, 1997), as do modern boxing and wrestling (Graves, 2009; Poliakoff, 1987). Sports like American football, pole vaulting, rugby, sprinting, and track and field throwing events require superior upper body strength and explosive power. The significantly greater upper body strength and muscularity of men relative to women (Abe, Kearns, and Fukunaga, 2003; Lassek and Gaulin, 2009) suggests a long history of male-male physical competition (Puts 2010). Men and women can quickly assess male upper-body strength and fighting ability from pictures of male bodies and faces, suggesting that fighting was an important cause of selection shaping human cognitive abilities (Sell et al., 2009).

We are unusual predators because we commonly throw projectiles to wound or kill

prey and rivals. Indeed, some have argued that the evolution of the ability to throw projectiles for distance, speed, and accuracy was a watershed event in human evolution (Fifer, 1987; Issac, 1987; Kolakowski and Malina, 1974). Bingham (1999, 2000) argued that the evolution of human social complexity paralleled our increasing ability to use projectiles to deliver death at a distance. Male sports often involve projectiles. For example, baseball puts a high premium on the ability of players to accurately throw and intercept projectiles either by hand or by bat. Interestingly, three modern athletic events involve throwing ancient projectile weapons, the discus, hammer, and javelin, for distance. Given the importance of these skills to success in hunting and warfare, there should have been strong selection on men to become proficient at these tasks. As predicted, men, on average, outperform women in tasks that involve aiming, catching, and throwing projectiles (Thomas and French, 1985; Watson and Kimura, 1991). Male-male competition and warfare, rather than hunting, were likely the selection pressures resulting in superior male skill at intercepting projectiles (Puts, 2010).

We do not know about prehistoric sports because of the paucity of the relevant archaeological record, but it is likely that the first athletic events were contests of the physical skills most important in fighting, hunting, and warfare (e.g., races, throwing contests, target games, and combat sports), just as those of modern hunter-gatherers (Chick, Loy, and Miracle, 1997; Eibl-Eibesfeldt, 1989; Guttman, 2004b; Loy and Hesketh, 1995). Combat sports and contests of hunting skills (e.g., archery, target shooting) remain common athletic events. Hunting is not a popular spectator sport because the presence of spectators would hinder the ability of hunters to stalk or ambush prey. Note that while hunting sports also use weapons of war, they are less popular than many other sports probably because they are risk free for competitors. Chick, Loy, and Miracle (1997) suggested that American football, boxing, lacrosse, and rugby grew directly out of training for warfare because these sham combat sports were most common in societies where external warfare was constant, occasional, or seasonal.

The male spectator lek hypothesis predicts that champion athletes in sports requiring the skills most needed in male-male physical competition and primitive hunting and warfare obtain the highest status and earn the highest salaries and winner's purses. Consistent with this prediction, 57 of the 70 (81%) top-earning athletes in the world in 2010-11 were men who played team sports requiring those skills. The list of the 50 top-earners in the USA (<http://sportsillustrated.cnn.com/specials/fortunate50-2011>) divides earnings into salary and endorsement components, while the list of 20 non-USA top-earners does not (<http://sportsillustrated.cnn.com/specials/fortunate50-2011/index.20.html>). Many American athletes earned more in endorsements than in salary or winnings. Factors other than athletic skill, including physical attractiveness, affect the amount of endorsements earned by athletes (Anonymous, 2006; Gilbert, 2007). Therefore, examining salaries and winner's purses, rather than endorsements, is more relevant to testing this prediction. Consistent with this prediction, American team athletes earned the top 30 of 50 (60%) salaries. Individual sport athletes ranked lower on the list; golfers ranked 31<sup>st</sup>, 49<sup>th</sup>, and 50<sup>th</sup>; auto racers 45<sup>th</sup>, 47<sup>th</sup>, and 48<sup>th</sup>. A significantly greater proportion of team (42/44, 95.5%) than individual sport athletes (1/6, 16.7%) earned more in salaries or purses than in endorsements (Fisher Exact Test,  $p < 0.0001$ ).

The financial reward for being a champion athlete is not only a modern phenomenon. Athletes during the Classical Era earned large winner's purses of money and goods that sometimes dwarfed, in relative terms, the winnings of modern athletes (Golden, 2008; Struck, 2010).

Furthermore, champion male athletes in sports that display the physical skills most required in male-male physical competition and primitive hunting and warfare typically achieve higher social and financial status than do champion athletes in other sports. For example, champion American football players typically attain higher status than do champion table tennis players. This observation is broadly consistent with the predictions of the male spectator lek hypothesis of sport.

### **Male Status is Correlated with Reproductive Success**

The relationships between male wealth, power, status and reproductive success are well known (e.g., Betzig, 1986; Borgerhoff-Mulder, 1987; Buss, 2007; Chagnon, 1979; Cronk, 1991; Hopcroft, 2006; Nettle and Pollet, 2008; Pérusse, 1993; Turke and Betzig, 1985). Generally, the positive relationship between male status and reproductive success favors in males the tendency to strive for status in a variety of competitive venues (e.g., art, business, politics, science, sport) (Irons, 1979). Male striving for status appears early in life, suggesting an early development of the responsible mental processes (Campbell, Muncer, and Odber, 1998) and strong selection favoring those processes (cf. Williams 1985). Many males begin to strive for status in non-athletic endeavors when they either fail to achieve high status as athletes or anticipate failure in the future. This realization may come as early as the ages of 9-10 when sports become more competitive (Hartmann, 2003). The rate at which boys stop competing at sports accelerates during adolescence when the intensity of athletic competition increases (Enoksen, 2011; Telama, Laakso, and Yang, 1994; Telama and Yang, 2000; VanMechelen, Twisk, Post, Snel, and Kemper, 2000).

### **Good Hunters Obtain High Status and Reproductive Success**

Success at hunting was a historically important path to high male status. Success at primitive hunting requires endurance, eye-hand coordination, knowledge, strength, and may take years of experience (e.g., Gurven, Kaplan, and Gutierrez, 2006; Ohtsuka, 1989). Because hunting is so difficult, hunting success is an honest display of ability (Gurven, Kaplan, and Gutierrez, 2006). Modern hunter-gatherers who are good hunters typically obtain high status (Gurven and von Rueden, 2006; Wiessner, 1996) and tend to have high reproductive success (Gurven and Hill, 2009; Smith, 2004, and references therein). Moreover, high status may also lead to deference from group members, alliance formation, help in childcare, and increased opportunities for trade, thereby producing positive effects on a champion hunter's inclusive fitness (Gurven and von Rueden 2006). That champion hunters are more attractive to other men as alliance partners is more consistent with the male spectator lek hypothesis of sport than with intersexual sexual selection hypotheses because champion hunters would have more likely been formidable competitors, rather than allies, of other men in the arena of intersexual selection.

### **Warriors Obtain High Status and Reproductive Success**

“... now you have come to the place of battle, where the best men are proved.”

Homer, *Odyssey*, XXIV

“...in the fighting where men win glory...”

Homer, *Iliad*, CLVI

Warriors, especially those that exhibit exceptional bravery during battle, are often rewarded with material goods and achieve high status, and thereby are able to gain access to fertile women (e.g., Gat, 2006; Keeley, 1996; Livingstone Smith, 2007). Moreover, the rape and capture of women by victorious warriors is well known in both ancient and modern warfare (e.g., Gat, 2006; Keeley, 1996; Livingstone Smith, 2007), sometimes producing large fitness benefits (e.g., Zerjal et al. 2003).

Modern warriors also have more reproductive opportunities than do non-warriors. For example, contemporary American men between the ages of 15-44 who served in the military reported having twice as many sexual partners per lifetime as men who did not serve (service median = 10.4 partners per lifetime vs. non-service median = 5.3 partners per lifetime); nearly 45% of servicemen reported having 15 or more partners per lifetime; just over 20% of non-service members reported that many partners (Mosher, Chandra, and Jones, 2005). Even if some of these partners included prostitutes, other data suggest that high military status results in more reproductive success. Rank in the officer corps of the U.S. Army is positively correlated with differential reproductive success (Mueller and Mazur, 1997).

Rival street gangs in the USA often engage in small-scale warfare similar to primitive warfare (Keeley, 1996) consisting of revenge attacks and conflicts over control of territory or economic activities (e.g., sale of illegal drugs). Palmer and Tilley (1995) showed that male street gang members had greater access to women than did non-gang members, suggesting that “warrior” status may confer reproductive opportunities in a variety of different contexts.

### **Champion Athletes Obtain High Status and Reproductive Success**

“Sport is the best way to fame for any man alive ...”

Homer, *Odyssey*, VIII

“You gotta be a football hero (to get along with the beautiful girls)”

Field, Lewis, and Sherman (1933)

Champion athletes have obtained high status throughout recorded history. Athletic success, especially in the “heavy” sports requiring combat skills, such as boxing, wrestling, and pankration (i.e., “total fighting,” a combination of boxing, wrestling, kicking, strangleholds, and pressure holds), produced high status in Classical Greece (Golden, 2008; Poliakoff, 1987; Sweet, 1987). Roman gladiators achieved great fame and were rewarded

with Roman citizenship, money, property, and access to power, making them attractive to women (Golden, 2008). Gladiators were such celebrities that their armor and weapons were prized as memorabilia by Roman senators (Golden, 2008).

Homer's sentiments are as true today as they were 2700 years ago. Champion athletes can achieve nearly instantaneous global fame if their performances occur at the Olympics or FIFA World Cup. With this fame come the wealth, power, and status that attract women (e.g., Buss, 2007; Low, 2000). While women generally find high status men sexually attractive (Buss, 2007; Miller, 2000), champion athletes seem to be especially attractive to them. The sexual attractiveness of champion male athletes to women may be rivaled only by the attractiveness of male singers and political leaders. Men may obtain high status in a variety of fields, but "champion" poets, businessmen, and scientists rarely, if ever, attract large crowds of adoring female fans. The observation that champion athletes may also have legions of primarily *male* fans, while champions in other fields typically do not, is more consistent with the male spectator lek hypothesis than with intersexual selection theories of sport.

Books, magazines, newspapers, and television broadcasts are filled with stories about the sexual exploits of athletes (e.g., Bouton, 1970; Entine, 2000; Hoberman, 1997; Leavy, 2010; Maraniss, 1999; Syed, 2008; Wahl and Wertheim, 1998). National Basketball Association Hall of Fame player Wilt Chamberlain claimed that between the ages of 15-55 he had sex with 20,000 women (i.e., 1.37 women per day for 40 years) (Chamberlain, 1991). Even if Chamberlain exaggerated his sexual exploits by a factor of 1000, he still had 4 times the number of sexual partners as did the median male aged 15-44 in the USA (i.e., 5.4 sexual partners per lifetime) (Mosher, Chandra, and Jones, 2005).

The genetic rewards from athletic success extend past the Western World. Among the Canela in Brazil, the winner of log-carrying races is allowed sexual access to a young woman who is eager to mate and bear his children (Guttmann, 2004b). Senegalese men who compete in ritual wrestling contests have greater reproductive success than do men who do not (Llaurens, Raymond, and Faurie, 2009). Success at combat sports in this and other societies (e.g., Poliakoff, 1987) may be simultaneously (1) used by men to evaluate potential allies and rivals because most combat sport spectators are men (i.e., intrasexual selection) and (2) an intersexually selected signal of quality used by women, or their male relatives, when choosing mates (Llaurens, Raymond, and Faurie, 2009).

The observation that champion athletes are sexually attractive to women does not falsify the male spectator lek hypothesis of sport. Women generally prefer men with high status who display markers of testosterone and good genes as short-term mates (e.g., Barrett, Dunbar, and Lycett, 2002; Buss, 2007; Geary, 2009). These same traits are also correlated with high status among men. Champion athletes have these physical characteristics and obtain high status by their performances.

A common theme in American mythology is that success on the athletic field results in upward social mobility (Hoberman, 1997; Smith, 2007). Loy (1972) studied the social origins and post-college career patterns of male athletes who earned at least three varsity letters representing the University of California – Los Angeles (UCLA) in intercollegiate contests between 1924 and 1968. Athletes, especially those who competed in sports requiring the skills needed for success in male-male physical competition and primitive

hunting and warfare (i.e., football, track and field, and wrestling), achieved higher status post-college occupations than those of their fathers. Loy (1972) did not detect any differences in occupational status among athletes who played different sports at UCLA. These results suggest that success in college athletics may result in a post-athletic career increase in socioeconomic status, especially for high achieving athletes like those in Loy's sample.

Recent studies, however, find little evidence that athletic success in high school is a good predictor of permanent increases in socioeconomic status (e.g., Barron, Ewing, and Waddell, 2000; DuBois, 1978; Sabo, Melnick, and Vanfossen, 1993). The male spectator lek hypothesis predicts that men who compete in athletics in college ultimately achieve higher post-college status than those who compete only in high school because athletic success in college is much more difficult (Leonard, 1996) and therefore a more reliable indicator of male quality.

The relationship between athletic success and status is not restricted to the USA; elite athletes in Nigeria (Sohi and Yusuff, 1987) and Hungary (Földesi, 2004) also experienced increases in social status, mostly because they began their athletic careers as members of lower socioeconomic classes.

The high status of professional athletes may be relatively short-lived. Reiss (1990) found that participation in professional sports in the U.S. did not usually result in permanent vertical status mobility for lower-class men; most returned to their pre-professional social status when their professional careers were completed. However, their high status during their playing careers would have made them sexually attractive to young women, increasing their reproductive opportunities.

Comparative data on the reproductive fitness of professional athletes from different sports could be used to test the idea that females are not attracted to athletic success per se but to the status earned by champion athletes in *particular* sports. The male spectator lek hypothesis predicts that champion athletes from sports that most require the skills used in male-male physical competition, primitive hunting and warfare would obtain the most reproductive opportunities. In historical eras without reliable contraception these reproductive opportunities would have resulted in reproductive success (Pérusse, 1993).

The positive effects of athletic success on male status are not restricted to adults. Grade school and high school boys in the U.S. who are champion athletes obtain high social status (Chase and Dummer, 1992; Holland and Andre, 1994). The relationship between athletic success and the popularity of schoolboys with other boys is consistent with the male spectator lek hypothesis of sport. High school athletes that played team sports like football, basketball, and baseball were sexually attractive to girls in several studies (e.g., Holland and Andre, 1994; Lyons, 2002; Miller, Sabo, Farrell, Barnes, and Melnick, 1998; Schulte-Hostedde, Eys, and Johnson, 2008).

College women are more sexually attracted to athletes than non-athletes in the U.S. (Snyder, Kirkpatrick, and Barrett, 2008) and France (Faurie, Pontier, and Raymond, 2004). Among French college athletes, greater athletic success was associated with more partners (Faurie, Pontier, and Raymond, 2004). Female athletes also reported more sexual partners than did non-athletes, but the effect of sports participation on partner number was stronger for men than for women (Faurie, Pontier, and Raymond, 2004). This observation is

anticipated by intersexual selection theory; women are attracted to high status men, whereas men are attracted to women that display youth and fertility regardless of their social status or athletic ability (Buss, 2007).

### **Men Watch Sports More Closely than Do Women**

“If you would read a man’s disposition, see him game;  
you will then learn more of him in one hour, than in seven years conversation.”  
Plato

Men, on average, are more avid sports fans than women. Approximately 75% of men describe themselves as sports fans, whereas about 50% of women do (Carrol, 2005). Men watch sports more often, are more interested in the outcome of athletic contests, talk about sports more often, and are more knowledgeable about the rules and history of sports and the exploits of athletes (e.g., Dietz-Uhler, Harrick, End, Jacquemotte, 2001; Ganz and Wenner, 1991; Guttmann, 1986; James and Ridinger, 2002; Kaufman and McLean, 1998; Rhoads, 2004; Winegard and Deaner, 2010). These observations are consistent with the male spectator lek hypothesis of sport and difficult to reconcile with intersexual selection theories of sport.

Men may watch sports for several non-mutually exclusive reasons:

(1) Men who watch other men play sports can inexpensively learn about the abilities of potential allies and rivals. Historically, this information could have had important consequences for survival and reproductive success if spectators learned (a) whom they should avoid fighting because they were likely to lose, (b) with whom they should form alliances, and (c) to avoid athletic situations where losing is likely so as to prevent a loss of status. The best strategy for achieving athletic success is to compete in sports where success is most likely. This strategy may help explain the evolution of the diversity of sports; men invent new sporting events to avoid competing in sports where they are less likely to be successful.

Men prefer watching sports that involve physical confrontations and emphasize team play (Carrol, 2005; Sargent, Zillman, and Weaver, 1998). This observation is broadly consistent with the male spectator lek hypothesis of sport. For example, in a 2008 poll of nearly 12,000 respondents in the U.S. by ESPN Sports Poll 9 out of 10 sports listed as favorite spectator sports were team sports involving direct physical confrontations between players (<http://www.sportsbusinessdaily.com/Daily/Issues/2009/07/Issue-213>). The only individual sport on the list, National Association for Stock Car Auto Racing (NASCAR), was ranked sixth. Interestingly, NASCAR races often involve dangerous direct confrontations between drivers.

In contrast, women tend to watch sports with family and friends, are less likely than men to watch sports alone (Hartmann, 2003), and prefer to watch sports that emphasize graceful body movements and lack overt aggression (e.g., figure skating, women’s gymnastics) (Sargent, Zillman, and Weaver, 1998). Evolutionary psychologists have hypothesized that women have evolved cognitive adaptations to assess male athletic ability, physical fitness, status, and thereby competitiveness (e.g., Hodges-Simeon, Gaulin, and

Puts, 2011; Hugill, Fink, Neave, and Seydel, 2009). However, women are more likely to obtain information about male athletes from men rather than their own observations because they prefer to watch different sports than do men (e.g., Gillespie, 2004), do not watch sports as often or as closely as do men (Dietz-Uhler, Harrick, End, and Jacquemotte, 2001; Ganz and Wenner, 1991), and rarely discuss sports with other women (Bischoping, 1993, and references therein). Because male status is primarily a consequence of intrasexual competition (Browne, 2002), women who focus their mate choice attention on men designated as champions by other men could save time and energy. In effect, they would be like female birds that copy the mate choices of other females on a display lek (Höglund and Alatalo 1995). They would also retain the ability to “verify” male rankings of other men with their own observations.

(2) It is often said that sports develop character, but as Plato noted, sports also reveal character. By watching other men play sports, especially men likely to be local competitors, male spectators could inexpensively learn who are cooperators or cheaters and thereby could modify their future behavioral interactions with them (de Block and Dewitte, 2009).

(3) Men who observed the behavioral proclivities of other men at play could benefit if they imitated the behaviors of successful men and avoided behaving like unsuccessful ones (cf. Alexander, 1990; Rendell et al., 2010).

(4) Men may derive vicarious thrills watching the athletic exploits of others, including identification with “idealized” men (Hartmann, 2003) and teams of men (Winegard and Deaner, 2010).

(5) Men may enjoy watching sports because they are reliving the exploits of their youth.

Explanations 1-4 are more consistent with the male spectator lek hypothesis than with intersexual selection theories of sport.

### **The Cultural Importance of Sport Increases as the Importance of Hunting and the Proportion of Men Who Experience Combat Decreases**

The male spectator lek hypothesis predicts that the cultural importance of sport increased when populations began to transition away from hunter-gatherer lifestyles approximately 10,000 years ago, because (1) hunting became progressively less important as a means of obtaining food (Price and Gebauer, 1995) and (2) the proportion of men who participated in war declined (Bowles, 2009; Gat, 2006; Keeley, 1996). Therefore, the relative importance of the display and evaluation functions of sport increased for two reasons. First, with the advent of agriculture the physical quality of potential allies and rivals was not as frequently available for evaluation. Success in agriculture requires, for the most part, different skills (e.g., knowledge of animal husbandry, climate, plant biology, and soil science) than does successful fighting, hunting, and warfare. Physical ability, while necessary for agricultural success, is not of paramount importance. Second, men had fewer opportunities to evaluate the fighting skills of others as the proportion of men that participated in combat decreased over time (Carter et al., 2006; Gat, 2006; Keegan, 1993). That combat sports remain popular in many cultures (e.g., Chick and Loy, 2001; Graves,

2009; Kyle, 2007; Loy and Hesketh, 1995; Poliakoff, 1987; Sipes, 1973) suggests that demonstrations of fighting skills retain important display and evaluation functions in the modern world.

Historically, sport would have been a less important arena than everyday activities for men to evaluate others. The physical skills that lead to success in hunting were available for evaluation to ancient hunter-gatherers nearly every day because of the frequency and demands of hunting. Modern hunter-gatherers can accurately assess the hunting abilities of men in their groups (Hill and Hurtado, 1996; Marlowe, 2003). For example, among the Aché of Paraguay and the Hadza of Tanzania, men prefer to hunt with other men who are good hunters because they get greater access to nutritionally valuable meat (Wood, 2006; Wood and Hill, 2000). In a sports analogy, they would rather be members of a winning team than the stars of a losing team. Only when Aché men have no dependents do they prefer to hunt with inferior hunters in order to “show off” (i.e., be the “star” of a losing team) (Gurven and Hill, 2009). This implies that (1) there would have been little need for regular athletic competition among ancient hunter-gatherers because everyone in a group would have frequently observed the physical prowess of fellow tribe members, and (2) because of a tendency for male philopatry (Lee, 1968; Lévi-Strauss, 1969; Marlowe, 2004; Rodseth, Wrangham, Harrigan, and Smuts, 1991; but see Hill et al., 2011), most males would have known each other since childhood and thus would have also known who were the best strategic thinkers, who were cowards, and who were brave. Indeed, being able to assess the abilities and proclivities of potential allies and rivals would be advantageous if individuals imitated the behaviors of champions and avoided imitating those of losers (Alexander, 1990). Recent research demonstrates the potential selective advantages of copying the adaptive choices of others (Rendell et al., 2010).

Furthermore, given the high activity levels (Fudge, Kayser, Westerterp, and Pitsiladis, 2007) and energetic demands of typical hunter-gatherer lifestyles (Hill and Hurtado, 1996; Lee, 1968; Marlowe, 2005), which are similar to that of modern elite distance runners in training (Fudge et al., 2007), adult men would have had little excess energy to expend on athletic contests. That athletic contests occur relatively infrequently among modern adult male hunter-gatherers (F. Marlowe, personal communication, March 2011) is consistent with the central argument of the male spectator lek hypothesis of sport and suggests that ancient athletic activity was constrained by energy availability and thus probably limited to youths.

Hunting has long been seen as training for warfare (Ashe, 1988; McComb, 2004). Primitive hunting and warfare differ in that warfare is riskier for warriors because their “prey” is other humans. Because war is more risky than hunting, men should be especially choosy about with whom they go into battle and prefer the best and bravest warriors in their group as allies. Displaying cowardice in the face of combat is the greatest fear of modern warriors entering battle for the first time (Dollard, 1944; McPherson, 1997; Stouffer et al., 1949). Yanomamö men view with contempt tribe-mates who habitually find excuses for not participating in revenge raids on neighboring villages (Chagnon, 1988). This suggests that men are especially sensitive to the displays of cowardice by themselves and others. The bravery of other men can be evaluated during sports involving physical confrontations and risks (e.g., combat sports) and extreme physical effort (e.g., endurance sports).

The explosive acceleration of sports participation and observation in the West began with the Industrial Revolution in the 1800s (Guttman, 1978, 2004a,b; McComb, 2004) and paralleled the accelerating (1) decrease in the importance of hunting as a means of sustenance, (2) decrease in the proportion of men who experienced combat (e.g., Gat, 2006; Keegan, 1993), (3) decrease in the mortality risk of participating in combat (Leland and Oboroceanu, 2010), (4) increase in the mechanization of warfare which placed fewer physical demands on warriors (e.g., van Creveld, 1989), and (5) increase in leisure time allowing more time and energy for adult male sports participation and observation (e.g., Guttman, 2004a; Huizinga, 1949). The relationship between the cultural importance of sport and these patterns suggests that sport replaced hunting and warfare as a way for men to evaluate the qualities of potential allies and rivals and is consistent with the male spectator lek hypothesis.

## **Summary**

Sport has received little attention from evolutionary biologists despite the fact that although sport is a human universal, participation and spectatorship is male-biased. Previous evolutionary theories of sport focused on sport as an arena for intersexual selection (e.g., deBlock and Dewitte, 2009; Miller, 2000). However, observations that women, on average, tend to show little interest in sports, the exploits of athletes, or the outcome of athletic events are difficult to reconcile with predictions generated by intersexual selection theories of sport. In contrast, I hypothesize that sport began as a way for men to develop the skills needed in male-male physical competition and primitive hunting and warfare, then evolved to provide them with physical training, an arena for intrasexual competition, and a display lek where male spectators could evaluate the qualities of potential allies and rivals. The male spectator lek hypothesis of sport assumes that athletic performance is an honest display of quality and predicts that:

- (1) Male sports develop the skills needed for success in male-male physical competition and primitive hunting and warfare,
- (2) the most popular spectator sports of men are those that most accurately display the skills needed for success in male-male physical competition and primitive hunting and warfare,
- (3) champion male athletes in sports that most require the skills needed for success in male-male physical competition and primitive hunting and warfare obtain the greatest status and most reproductive opportunities,
- (4) champion male athletes at highest levels of competition obtain the greatest status and the most reproductive opportunities,
- (5) men invent new sporting events to avoid competing at sports where they are likely to lose,
- (6) men should be more avid sports fans than women,
- (7) male spectatorship at the local level may be adaptive for male spectators if they use the athletic performances of local competitors to modify their behavioral interactions with them, and
- (8) sport increased in cultural importance as fighting, hunting, and warfare became less

important selection pressures.

The characteristics of historical and modern sports are consistent with the predictions of the male spectator lek hypothesis. Observations that champion male athletes in sports requiring the skills needed for success in fighting and primitive hunting and warfare obtain the most reproductive opportunities supports intersexual selection theories of sport (Miller, 2000; deBlock and Dewitte, 2009). These results suggest that while intrasexual and intersexual selection both influenced the evolution of sport, the primary driving force shaping the characteristics of male sports and athletes was intrasexual competition. This conclusion is consistent with the hypothesis that contest competition was an important selection pressure shaping male characteristics, including those preferred by women during mate choice (Puts, 2010).

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