

## *Rough-and-Tumble Play from Childhood through Adolescence: Development and Possible Functions*

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In this chapter I will first define a specific form of play, rough-and-tumble (R&T) play, describe how it develops across the life span, and make some inferences about its possible functions.

### **Defining R&T**

#### *Behavioral, consequential, structural, and ecological dimensions*

Often R&T is confused with aggression because at some levels they resemble each other. Upon close inspection, however, they are clearly different. In this section I will briefly explicate those differences. Categories of behavior, like aggression and R&T, can be defined along the following dimensions: individual behaviors, consequences, structure, ecology, and developmental trajectories.

*Behaviors.* Beginning with individual behaviors, numerous factor analytic studies have differentiated R&T and aggression behaviorally (e.g., Blurton Jones, 1972) in the following reliable ways. The assumption here is that behaviors with similar meaning will co-

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occur and form a meaningful category. R&T is typically composed of: run, chase, flee, wrestle, open hand hit. Aggression is typified by: closed hand hits, shoves, pushes, and kicks. Also a quite simple, yet reliable, way in which R&T and aggression differ is in terms of expression of affect. Generally, smiles (or a play face) accompany R&T while frowns, or crying, accompany aggression.

*Consequences.* Classes of behavior can also be differentiated in terms of consequences, or those behaviors immediately following the target behaviors R&T and aggression. As in the case of co-occurring behaviors we assume that behaviors which follow a focal behavior systematically are related to that antecedent in a meaningful way. In many cases we can make assumptions about the meaning, or function of an antecedent behavior based on its consequence. For example, when R&T bouts end, children often stay together and begin cooperative social games (Pellegrini, 1988). Aggression, on the other hand, often leads to one of the participants trying to separate from the other (McGrew, 1972). Thus, R&T may have peer affiliative functions whereas aggression does not.

*Structure.* The structure of R&T is also different from aggression. By structure I mean the roles that typify each class of behaviors. In R&T youngsters alternate roles, such as chaser and chasee. In some cases, stronger or bigger players “self-handicap” so as to sustain play. For example, an older child may pretend to fall as he is trying to escape from a pursuer, thus enabling the younger child to “capture” him. Self-handicapping enables children of different levels of strength and physical prowess to play together. Role alternation is a hallmark of other forms of play, such as dramatic play where children often change, or negotiate, roles repeatedly in the course of an episode. Role alternation seems to play an important part in children’s social perspective taking; taking different play roles, both in fantasy (Garvey, 1990) and R&T (Pellegrini, 1993), enables children to take different perspectives. Aggression, on the other hand, is typified by unilateral roles: Aggressors don’t switch roles with their victims.

*Ecology.* Ecologically, R&T tends to occur in spacious areas, such as the outdoors (Smith & Connolly, 1980), and on those parts of playgrounds with soft, grassy surfaces (Pellegrini, 1989b). That R&T is physically vigorous and involves running, falling, and wrestling means that it is more likely to occur in areas supportive of this sort of behavior, compared to more confined areas.

Aggression does not, however, vary according to playground location (Pellegrini, 1989a); it is equally likely to occur anywhere. Among preschoolers, where toys are present, however, aggression is likely to result from children’s disputes over objects (Smith & Connolly, 1980).

These differences are empirically verified to the extent that for most children R&T and aggression are not significantly intercorrelated (Blurton Jones, 1972; Fry, 1987; Pellegrini, 1988). Further, aggression and R&T appear to be under the control of different neural and endocrinological systems (Meaney, Stewart, & Beatty, 1985). Additionally, these differences have been observed cross-culturally; for example, among foraging bushmen (Konner, 1972), indigenous Mexican people (Fry, 1987), and in India (Roopnarine, Hooper, Ahmeduzzaman, & Pollack, 1993). As we will see in the next section, R&T leads children into a very positive developmental trajectory; this is not the case for aggression.

## The Developmental Trajectory of R&T

The distinction between R&T and aggression is further evidenced by the fact that each has a different developmental trajectory. R&T, like other forms of play (Fagen, 1981), follows an inverted-U developmental curve. Pellegrini and Smith (1998) propose that R&T is the end point on the developmental continuum of physical play which begins with rhythmic stereotypies (which peaks in infancy), moves into exercise play (which peaks during the preschool period), and finally into R&T. Unlike these other forms of physical play, R&T, by definition, has a social dimension.

The earliest cases of R&T are observed between young children and their parents. This is a form of play in which father and sons typically engage (e.g., Parke, Cassidy, Burks, Carson, & Boyum, 1992) and by 4 years of age, it accounts for about 4% of all parent-child behavior (Jacklin, DiPietro, & Maccoby, 1984).

R&T with peers accounts for about 5% of the free play of preschoolers, increases to 10–17% of the play of elementary school children, and declines in middle school to about 5% (Humphreys & Smith, 1984). These figures probably underestimate time spent in R&T, given the bias toward the documenting fantasy play during childhood. That is, in many cases, especially for preschool boys, fantasy and R&T co-occur (Pellegrini & Perlmutter, 1987), and end up being counted as fantasy, not R&T. Clearly more observational work is needed where R&T is examined more carefully in relation to fantasy play.

### *Sex differences*

Males of most primate species engage in R&T more frequently than females (Fagen, 1981; Smith, 1982). This is a very robust finding in the animal and child development literature, being observed cross-culturally in the latter (Pellegrini & Smith, 1998). Differences in initiations of and responses to R&T overtures are crucial in understanding these differences. Males tend to show higher rates of initiations and females higher rates of withdrawals (Meaney et al., 1985). The higher withdrawal rates by females may be due to corresponding differences in response to tactile stimulation of the sort characterizing R&T (Meaney et al., 1985). These differences, in turn, help explain the segregation of boys' and girls' play groups throughout childhood (Maccoby, 1998).

Sex differences in R&T are probably the result of both hormonal and socialization events (Maccoby, 1998), where endogenous and exogenous androgens affect neural organization and behavior. Normal exposure to androgens during fetal development predisposes boys toward physical activity and R&T. Socialization interacts with hormonal events to reinforce these difference (Maccoby, 1998). Starting in infancy, fathers spend more time with sons, compared to daughters (Parke & Suomi, 1981), and when with their sons, may engage in physically vigorous forms of play, including R&T (Carson, Burks, & Parke, 1993; MacDonald & Parke, 1986). Further, girls, compared to boys, are more closely supervised by adults (Fagot, 1994) and they are likely to discourage rough forms of play (Maccoby, 1998).

*Individual differences*

In most cases R&T does not co-occur with or escalate to aggression (Pellegrini, 1988). Further, young children and adults from a variety of nations (e.g., United States, UK, Italy) are able to reliably distinguish R&T from aggression (Costabile et al., 1991; Pellegrini, 1989b). However, there are individual differences in the expression and perception of R&T. Primary school boys who are sociometrically rejected (i.e., they are disliked by more of their peers than they are liked) and physically aggressive tend to engage in R&T at rates similar to boys of average popularity. The R&T for this first class of boys, however, co-occurs with aggression. That is, rates of aggression and R&T are significantly intercorrelated (Pellegrini, 1988). This may be due to the fact that the R&T of these boys “escalates” into aggression; that is, when an R&T bout ends, aggression follows in one case out of five (Pellegrini, 1988). Further, rejected boys, relative to popular boys, are less accurate in differentiating R&T from aggression (Pellegrini, 1989b). Boys who are aggressive and sociometrically rejected in the primary grades, retain their status as they move into adolescence. In adolescence, however, these boys engage in a particularly rough form of R&T and tend to use R&T to bully their peers (Pellegrini, 1994). While rates of R&T decline markedly for most adolescent boys the R&T of rejected boys remains relatively high and continues to relate to aggression (Pellegrini, 1994).

Children’s R&T “escalates” into aggression for at least three different reasons. First, for most children the transition from R&T to aggression may be an “honest mistake” (Fagen, 1981). Mistakes occur, such as one child slipping or accidentally hitting too hard, and can be judged by looking at the expression on the face of the initiator at the instant of the “mistake.” A look of surprise probably indicates an accident.

Second, youngsters can exploit the playful tenor of R&T in a more Machiavellian way, by turning R&T into aggressive exploitation; for example, they could hit too hard or not change role. Youngsters may apologize for their “mistakes” when in fact they were intentional. These youngsters seem to deliberately exploit R&T in this way as a way in which to publicly exhibit their dominance over a peer. The occurrence of this sort of behavior in the presence of a crowd or in the presence of high status peers may indicate exploitation. We have also found that when new social groups are forming, youngsters whose dominance status is rising use this strategy with higher ranking individuals, as a way to move up the hierarchy. Youngsters whose status is falling use it only with lower status individuals (Pellegrini, 1995b). In these sorts of cases, individuals are socially sophisticated in their use of aggression; their use of these strategies is related to their ability to take others’ points of view (Pellegrini, 1995a).

Third, there are other youngsters whose R&T moves into aggression because they are overly emotional, cannot control themselves, and who might be interpreted as deficient in their interpretation of ambiguous, provocative social information. When presented with R&T, they interpret it as aggressive and respond accordingly.

## Functions of R&T

Function is defined, for the purposes of this chapter, in terms of “beneficial consequences” (Hinde, 1980). These consequences can be either immediate or deferred. The dominant view, for much of this century (Groos, 1901), has been that play has deferred benefits; that is, play has been considered practice for adulthood. During the period of extended childhood, children engage in play to learn and practice those skills necessary to be functioning adult members of society. This view is reflected in both Piaget’s (1962) and Vygotsky’s (1978) theories of play. This assumption is related to the long-held emphasis among child developmentalists on the importance of early experience and developmental continuity. Bateson’s (1976) metaphor for the deferred benefit view of play is “scaffolding”; play functions in skill assembly and then is disassembled when the skill is mastered.

Alternatively, play may be viewed not as an incomplete or imperfect version of adult behavior, but as having immediate benefits during childhood. This “metamorphic” (Bateson, 1976) view posits that play and its consequences are unique to the niche of childhood and that later benefits are not necessary for its explanation. This view is consistent with recent discussions of benefits suggesting that play occurs at specific periods during which development may be modified (Byers & Walker, 1995). Accordingly, the previously discussed age distribution of R&T may be useful in evaluating functional hypotheses.

### *Social functions of R&T*

The distinct functional significance of R&T is suggested by two arguments. The first is the relative and peak frequencies with which it is observed during childhood. R&T peaks during the middle childhood period, when it accounts for about 10% of free-play behavior; it then declines in adolescence, accounting for less than 5%. This peak period co-occurs with the time during which peer relations are becoming increasingly important in children’s lives (Waters & Sroufe, 1983), thus, and as will be discussed below, R&T may be related to learning skills important for peer relations.

The second is an argument by design. R&T is a distinctive form of behavior. It is superficially similar to real fighting; however, it is different in many respects and should be regarded as a separate construct. I review here evidence relating R&T to social skills, fighting skills, and to dominance functions.

*R&T and social skills.* An important dimension of social skill is the ability to encode and decode social signals. Successful encoding and decoding of messages, such as “This is play,” is necessary if play is to be initiated and maintained (e.g., Bekoff, 1995). Behaviors that send the message “This is play” are typically exaggerated, compared to more functional counterparts; for example, play fighting, compared to real fighting, might be characterized by open mouth, hunched shoulders and rhythmic movement of the hands.

Research by Parke and colleagues indicates that the ability to encode and decode play signals can originate in socially vigorous play between parents (primarily fathers) and their children (primarily sons), beginning in infancy and continuing throughout childhood (Parke

et al., 1992). They found the amount of time spent in vigorous play bouts to be positively related to preschool children's ability to decode emotional expressions. Further, children's expression of emotional states was also related positively to bout length. Involvement in R&T with peers, expressed in terms of proportion of total behavioral output, has also been found to relate to primary school children's ability to decode play signals (Pellegrini, 1988). It may thus be the case that parent-child play provides the groundwork for children's ability to encode and decode emotions, with this ability later being used in physical activity play with peers.

However, there are difficulties with this hypothesis. First, these correlational studies do not establish cause and effect; it is equally plausible that the causal relationship is such that (for example) those children less able to encode/decode emotions are less willing to engage in R&T. Second, and more conclusively, these hypotheses are inconsistent with observed sex differences; encoding and decoding of emotions should be just as important for girls as for boys, and they certainly are no worse at it than boys. Yet, the sex difference in R&T is a well-established finding.

*R&T and fighting skills.* The most traditional view in the animal and human literature (e.g., Smith, 1982) is that R&T functions to provide safe practice for fighting (and possibly, hunting) skills which will be useful in later life. This hypothesis would be consistent with the strong sex difference observed, if one assumes that fighting (and hunting) skills were and are more characteristically male activities (Boulton & Smith, 1992). It does not predict the age curve for R&T, since "safe" practice for such skills might be especially important in adolescence (when in fact R&T declines). Also, there is little or no direct evidence linking R&T to fighting or hunting skills, in either the animal or human literature (Martin & Caro, 1985). Finally, this hypothesis does not predict the age changes in "cheating" observed in human R&T. Thus, while I do not dismiss this argument – indeed, I suspect it may be a phylogenetically prior function with some remaining relevance for younger children – I review here the argument for dominance functions of R&T, which have not received the same attention but which may yield new insights in the case of human R&T (Pellegrini & Smith, 1998).

*R&T and dominance relationships.* Dominance is defined as a dyadic, affiliative relationship between individuals, not in terms of one's aggressiveness (Hinde, 1980), though physically aggressive behaviors are often used in the service of dominance. Aggression and affiliative behaviors are correlated with individual's dominance status during childhood (Strayer & Noel, 1986) and adolescence (Pellegrini & Bartini, 2001). Further, dominance hierarchies are generally unique to specific groups and ecologies, the implication being that individuals might have different dominance status in different groups and ecologies (Strayer, 1980). Although explicable in terms of advantage to dominant individuals, dominance hierarchies also mediate group members' access to valued resources and reduce intragroup aggression in many situations (Strayer, 1980). Thus dominance hierarchies benefit individuals (in terms of access to resources and minimized aggression) and the group (in terms of group affiliation).

I postulate that R&T may serve a social function in peer groups, for boys especially, by assisting in the establishing and maintaining of social leadership or dominance relation-

ships. The idea that R&T is related to establishing and maintaining dominance status is consistent with arguments from design. Males often use quasi-agonistic displays (e.g., soft or no contact kicks and punches, light pushes) in the service of dominance. Very similar behaviors are also displayed in R&T, but these behaviors are embedded in a nonserious context: Kicks and punches don't make contact and if they do they are soft; players are smiling; and they often handicap themselves (e.g., let the player on the bottom of a pile get on top).

Symons (1978) was critical of the hypothesis that R&T is related to dominance because of the findings in primate (and child) research on R&T that self-handicapping occurs: Blows are not forceful, and individuals take turns to gain or cede the upper position in wrestling. However, subsequent findings counter this argument in two ways that I review in more detail below. First, children can often evaluate the strength of others from R&T bouts, despite self-handicapping and restraint. Second, in some youngsters (and especially by adolescence), it now appears that subtle or not so subtle forms of "cheating" may occur, demonstrating clearly to opponents and to onlookers, that one participant is in fact stronger (Smith & Boulton, 1990).

This argument is also consistent with the sex differences in R&T. Children establish and maintain dominance in different ways. Girls primarily use verbal, rather than physical, means to gain and keep resources (Charlesworth & Dzur, 1987). Boys, on the other hand, utilize a variety of skills, some of which are related to physical prowess, to regulate access to resources: for example, struggling over access to a toy. Fighting skills, or toughness, when used in conjunction with more affiliative skills is an important dimension of boys' peer-group status and popularity (Pellegrini & Bartini, 2001). It may be the case that dominant individuals reconcile (e.g., shake hands, offer gifts, etc.) after their aggressive acts as a way in which to maintain group harmony (deWaal, 1985). Additionally, leaders may use aggression to stop fights or to help their allies (Strayer & Noel, 1986).

Age trends in R&T also are consistent with this position, if we consider that the immediate preadolescent period is one in which it is important to establish peer-group dominance. At this age, youngsters experience rapid change in body size along with changes in environment, as they move from primary to secondary school. Thus, R&T, along with other agonistic and affiliative strategies is used by boys to establish dominance (Pellegrini & Bartini, 2001).

Observational and interview evidence suggest that R&T may be involved in dominance in two ways, each of which are age related. The first is indirect; R&T may provide a way of assessing the strength of others, so as to decide one's strategy vis-à-vis dominance competition – a form of "ritualized aggression," which leads to real fighting in only certain circumstances. Similarly, children's R&T occurs in symmetrical groups, or children of similar dominance status, and many children say they can determine their own as well as peers' strength from these encounters (Smith, Hunter, Carvalho, & Costabile, 1992). Also with children, R&T occurs between friends (Humphreys & Smith, 1987; Smith & Lewis, 1985) and in groups of 3 to 4 children (Pellegrini, 1993) and this indicates that it is a safe and relatively visible venue to test and exhibit physical strength. That R&T occurs in symmetrical groups and that children can determine peers' strength from these encounters suggests that it can be used in this first, indirect way, to assess strength and prepare for dominance encounters, through the primary school period.

The second way in which R&T may provide the context for establishing or maintaining dominance is more direct. A participant may use an R&T bout to get their partner in a position where they can actually display their superior strength, or assert dominance, for example, by pinning or intimidating a playmate. Indeed, the participant doing this may have lulled their partner into a false sense of security by using the predominantly playful nature of R&T, or have used the self-handicapping and reversal criteria of R&T to get themselves into a “winning” position. Thus, this could be called a “cheating” use of R&T for dominance purposes and was discussed above.

So far as preadolescent children are concerned R&T is not correlated with peer-nominated dominance in that it occurs with partners of similar dominance status (Humphreys & Smith, 1987; Pellegrini, 1993). In most cases, R&T is not exploited for immediate aggressive ends (Pellegrini, 1988). This suggests that R&T may not often be used to establish dominance in this second way, directly, before adolescence.

While R&T and actual fighting remain separate for most children during the primary school years, there are cases, especially involving sociometrically rejected children (Pellegrini, 1988), where R&T and fighting are linked. The ethnographic record provides illustrations. Sluckin's (1981) in-depth study of British 5- to 9-year-old children's behavior and perceptions of their lives in the school playground provides examples of R&T being used to deceive and manipulate peers. Similarly, the work of Oswald and colleagues (1987) in Germany with children aged 6- to 10-years-of-age found instances of hurtfulness in the play of the older children in this age range.

However a clearly different picture emerges in early adolescence. Neill (1976) was the first to suggest that adolescent boys' R&T might be used to establish dominance. His factor analytic study of boys' playground behavior found that R&T and aggression often co-occurred. Neill stated that R&T might be a “means of asserting or maintaining dominance; once a weaker boy has registered distress the bond can be maintained by the fight taking a more playful form, but if he does not do so at the start of the fight, the stronger boy may increase the intensity of the fight until he does” (p. 219). This age change in the function of R&T received some support from Humphreys and Smith (1987). They found that at 11 years, but not at 7 and 9 years, dominance was a factor in partner choice in R&T. When the younger children engaged in R&T they did so in symmetrical groups, or with peers of similar dominance status; for the older children, dominant youngsters initiated R&T with less dominant youngsters, or in asymmetrical groups. This finding would be consistent with stronger children using R&T to exhibit dominance with weaker children.

Results from a study by Pellegrini (1995b) throw further light on this age trend. In a longitudinal study of adolescent boys, he found that asymmetrical choices for R&T were observed during the first year of middle school, but not the second. He also found that during the first year of middle school boys' R&T was correlated with peer-nominated dominance. (Only with sociometrically rejected boys, not popular or average boys, did R&T lead to and relate to aggression, however.) During the second year of middle school R&T continued to relate to dominance status but it did not lead or relate to aggression. These results suggest that R&T is used to establish dominance in early adolescence; and that once established, hierarchies reduce aggression and R&T declines.

In summary, I suggest that the primary function of R&T through the primary years is to

provide a way in which boys assess strength of others for dominance purposes; possibly additional to providing practice in fighting skills, for which, however, little direct evidence exists. There is good evidence that in early adolescence (and perhaps earlier for rejected children) R&T functions to actually establish dominance status in boys' peer groups. The contemporaneous correlations between R&T and dominance and R&T and popularity for adolescent boys suggest that R&T is only one behavioral strategy used by boys to gain and maintain status. Finally, I suggest that any benefits for emotional encoding, decoding, or regulation are incidental benefits of R&T, achievable in other ways, rather than functions.

### **Suggestions for Future Research**

As noted above, the study of children's R&T has been limited. Most studies of preschoolers' play, following Piagetian theory, have been concerned primarily with pretend play while less attention is given to functional and constructive play. Given the co-occurrence of R&T and pretend play and the theoretical bias toward studying pretend play, it may have been the case that the occurrence of R&T during the preschool period has been under-reported.

Future research should re-evaluate the place of R&T during the preschool period by considering its pretend and nonpretend dimensions, as well as the play-fighting and chase dimensions. The distinction between chase and play fighting is important for a number of reasons. First, most young children enjoy chasing and fewer, mostly boys, enjoy play fighting (Smith et al., 1992). Second, chasing and play fighting, at least for older children, are statistically independent of each other and have different consequences: play fighting relates to dominance status while chase does not (Pellegrini, 1995b).

Along similar lines, to what degree do play fighting and chasing lead to aggression during the preschool period? That play fighting leads to aggression for sociometrically rejected children during the primary and middle school periods (Pellegrini, 1988, 1994) suggests that the R&T of aggressive/rejected preschoolers might also lead to aggression.

We also need to know the ways in which physically vigorous behavior is used by boys to establish and maintain social leadership in their peer groups. I hypothesize that R&T would be an important predictor of peer leadership, including dominance, especially as they enter new social institutions, such as a new school. From this view, socially competent children may use a variety of agonistic and cooperative strategies to get their way with peers (Vaughn, 1999). Children, however, should not cheat repeatedly at R&T. Where cheating does occur it should be in the presence of a crowd (who can witness the result of cheating). It may be the case that boys initially cheat at R&T by inflicting pain and thereby gaining public notice of their "toughness," then apologize (under the guise of an "honest mistake") and resume another form of play or social interaction. Alternatively, honest mistakes, rather than cheating, may be "punctuated" by subsequent play signals to reinforce the playful intent (Bekoff, 1995).

Differences in sociometric status also may interact in interesting ways with dominance functions of R&T. It appears that sociometrically rejected children are most likely to "cheat"

in R&T, and use R&T in overly aggressive ways: By contrast, popular children may be dominant but do not “cheat” so frequently or obviously in their R&T (Boulton & Smith, 1990; Pellegrini, 1988, 1995a). It may be that children are employing different strategies of seeking power. Popular children may do so by demonstrating leadership in ways which may occasionally involve physical strength; rejected children may do so by using R&T and aggression to demonstrate physical dominance over others. If so, R&T may function as one optional strategy for seeking social dominance.

Social skills learned during peer play might include the abilities to detect “cheating” and to regulate physically vigorous play and R&T. Ability to detect cheating could be measured by children’s responses to filmed play and aggressive bouts or by observing their responses to instances of cheating. For instance, in response to cheating, targets should terminate the bout and also turn away from the cheater. Direct observation of aggression would be very difficult to collect given their relative infrequency, thus hypothetical situations may be more practical. Use of video and playback procedures (for both participants and nonparticipants) may be useful here.

Lastly, sex differences are important to consider. Researchers should trace the developmental trajectories of boys and girls from infancy through adolescence, observing directly the extent to which children have opportunities for R&T with parents and for play with peers and large motor toys. These observations should be made in conjunction with measures of children’s sensitivity to tactile stimulation, for example, do boys and girls respond differently to R&T initiations?

While differential responses to physical stimulation should be related to sex differences in the preference for physical contact play (Meaney et al., 1985), it also may be the case that there are individual differences, associated with factors such as congenital adrenal hyperplasia (CAH) within each sex. Longitudinal observations should be made of CAH and non-CAH girls’ and boys’ sensitivity to tactile stimulation as well as their R&T with parents and then peers. Early observations of tactile sensitivity and subsequent play with parents should provide information on the specific and interactive contributions of each factor to children’s engagement in R&T with peers.

### *Testing functional hypotheses with cost-benefit analyses*

In this chapter I made functional inferences based on the co-occurrence between physical activity play and beneficial consequences in social organization status and social skills. Play may occur at specific ages, which may be sensitive periods in development, and consequently, play may affect these skills.

A complementary approach to the study of function, cost-benefit analyses, has been applied to animal play with results generally supporting the theory (e.g., Martin & Caro, 1985). From an evolutionary perspective, costs associated with play should have corresponding benefits for the individuals of the species in which the play behavior is typically observed. If this were not the case, play would not have been naturally selected for and maintained across the generations. The animal play data generally support the correspondence between costs of play and accrued benefits (Fagen, 1981).

Costs associated with physical activity play can be expressed in terms of time spent

playing, calories, or energy expended, during play, or in terms of survivorship where death or injury occurs as a result of play (Martin & Caro, 1985). High costs should be associated with high benefits and low costs could be associated with either high or low benefits. Benefits for play need not be absolutely high but merely greater than associated costs.

Application of a cost-benefit analysis to children's play would be useful on a number of fronts. First, we should empirically test the wide-held assumption that play during childhood is costly; that is, that play consumes a substantial portion of children's time and energy budgets. Second, a description of the time and energy expenditure on physical activity play across childhood would complement the information provided in this review and that provided by Pellegrini and Smith (1998). Functional hypotheses could be evaluated by relating different measures of cost to measures of motor training, cognitive performance, and social organization status and skills during childhood and into adulthood. A necessary first step, however, involves documenting costs associated with physical activity play.

Costs can be documented by measuring the caloric expenditure during play, relative to resting states, across the day (Pellegrini, Horvat, & Huberty, 1998). Documenting play metabolic rate (PMR) involves taking direct measures of energy expenditure, for example, using heart rate monitors and accelerometers, during children's play and during resting states, or resting metabolic rate (RMR). In this way the cost of play, beyond the cost of maintaining a resting state can be gauged. Additionally, these mechanical recording device should be used to document the average daily metabolic rate (ADMR); estimates of ADMR range from 1.5 to 3.0 times RMR (Martin, 1982). Next, the amount of time during the day spent in play ( $t_p$ ) should be estimated. This can be accomplished by having children or adults recording in diaries the time spent in play. Alternatively, spot sampling can be utilized, where researchers call the homes of children during the day and ask caregivers to report on children's activities. Martin suggest that .05 is a "realistic" estimate of time spent in play across the day. The caloric cost of play can then be derived from the following formula, suggested by Martin (1982):  $ECP = t_p (PMR - RMR / ADMR)$ .

This sort of analysis has been applied extensively to animals' play (see Martin & Caro, 1985 for a summary) with the results suggesting that physical activity play accounts for 5%–10% of total energy costs. Given this rather low level of cost, we most reasonably would search for immediate, not deferred, benefits in the domains of physical and social skills.

This method to establish the value, or function, of R&T in childhood and adolescence is rather indirect. A more direct method of assessing function is to simply ask youngsters about the meaning and function of R&T. This can be accomplished with questionnaires which ask them questions about R&T in general, or by showing them filmed R&T and aggressive bouts and then asking them questions about those bouts. Variants of both of these procedures have been used widely.

Smith and colleagues have developed and used questionnaire procedures with children in the UK and Italy (Costabile et al., 1991; Smith et al., 1992). Children were asked a series of questions about their perceptions of R&T and aggression; for example, the frequency with which they engage in R&T, the identity of their partners in R&T, and their reasons for engaging in R&T. These studies, like the behavioral studies discussed above, clearly show that children differentiate R&T from aggression and can give reasons sup-

porting their judgments. Generally, children say they engage in R&T, not surprisingly, because it is fun.

The videotape methodology that has been used takes two forms. The more common variant of this procedure has children viewing videotapes of the R&T and aggression of unfamiliar children. Children clearly differentiate R&T from aggression and can give numerous reasons for doing so (Pellegrini, 1989a,b). However, individual differences also crop up here. Rejected children, compared to popular children, are neither very accurate in their discriminations nor do they give as many reasons for their decisions. This difference may be due to the social information-processing deficit described by Dodge (e.g., Dodge & Frame, 1982). Briefly, this argument suggests that rejected children simply do not process ambiguous, provocative interaction (like R&T) accurately. When they see an ambiguous/provocative event (that can be either playful or aggressive) they tend to attribute aggressive intent to it; thus, R&T is seen as aggression.

An explanation for rejected children's poor performance on these discrimination tasks posits that these children, as general "problem children" in school, take on a negative stance when they are being interviewed. As a way in which to project this negative image to the interviewer they label R&T bouts as aggressive (thus the aggressive bias) and minimally comply to requests to give reasons for their responses (thus the low number of attributes given to differentiate R&T from aggression). In short, their responses may have been a way of expressing defiance/noncompliance to an adult in school.

This purposeful, rather than deficient, explanation is consistent with other research showing that rejected boys are also very purposeful in their choice of R&T partners. For a particularly rough variant of R&T, but not other forms of social interaction, rejected boys (who are also considered to be "tough" by their peers) initiate interaction with boys who are weaker than they; these targets are also considered "victims" by their peers. These R&T bouts typically escalate into aggression at a greater than chance probability (Pellegrini, 1994). Thus, "tough" boys may use R&T as a pretext for victimizing less dominant boys. This conclusion is consistent with the view that some aggressive children (bullies) are very good at inferring what their peers are thinking (Sutton, Smith, & Swettenham, 1999).

Another, less commonly used videotape method involves showing children (and their teachers) aggressive and R&T bouts in which they and their classmates were participants (Smith, Smees, Pellegrini, & Menesini, 1993). We showed films to children (individually, not together) who participated in these films on the same day as the bouts and again two weeks later. We also showed the films to the classmates and teachers of these children at the same intervals. We reckoned that asking children to comment on bouts in which they actually participated would provide more direct insight into the meaning of these events. Further, by asking both teachers and children to comment on the events we could contrast their interpretations of the same events. We originally thought that teachers' interpretations would have been inaccurate and at odds with children's, as found by Schafer and Smith (1996).

We found that participants' agreed with each other on the meaning of the event (i.e., whether it was R&T or aggression); this agreement was stable across a 2-week period. To our surprise, however, nonparticipating peers and teachers' agreed with each other, but their interpretations were significantly different from participants.

Participant status, however, may be a proxy for something else. It may be the case that

these participants are also friends and have a different sort of relationship than do nonparticipants. We know, for example, that friends tend to engage in R&T with each other, more than with peers who are not friends (Humphreys & Smith, 1987). We also know that friends have a more accurate understanding of each other than do nonfriends (Hartup, 1996). Thus, in our study it may be that our R&T participants agreed with each because they were friends.

These results have very clear implications for both research and educational policy. Researchers should clearly make provision for the differing interpretations of ambiguous provocation events, like R&T, when they interview children. From a policy perspective, these results suggest that in order to understand certain forms of behavior, like aggression and R&T, teachers and school administrators should interview participants and their friends, and not rely on what bystanders say.

## Conclusions

I have outlined the ways in which one form of play, R&T, differs from aggression. As part of this exposition I reviewed evidence showing that R&T and aggression had very different developmental histories and, consequentially, had very different impacts on children's social cognitive status. R&T is quite "normal" and actually a "good" form of play for young children, particularly boys. It may be the case that engaging in R&T affords opportunity to practice encoding and decoding social information. Further, the role alternation characteristic of R&T may be an important component in perspective taking. These skills, learned and practiced in R&T during childhood, are then utilized in other forms of reciprocal social interaction, such as cooperative games, during adolescence.

An interesting developmental shift occurs in adolescence. R&T no longer has positive implications for social cognitive development. During this period, R&T is used primarily in the service of social dominance. Thus, this is an interesting case of a set of behaviors serving different functions for different youngsters (i.e., rejected vs. popular) at different periods (i.e., childhood vs. adolescence).

Another important conclusion to be drawn from this work is that not all children seem to need this specific form of play to develop. R&T is a particularly male phenomenon and many boys seem to use it in the service of their social cognitive development. That girls (and some boys) generally do not engage in R&T but also develop into well-functioning social beings is illustrative. Girls use other strategies to become socially competent. That girls engage in social pretence play at high rates, compared to boys, suggests that this form of play, not R&T, is important for their social cognitive development. In short, not all children must travel the same developmental path to competence. Children often take different paths to the same developmental outcome. This sort of behavioral flexibility seems crucial in light of the fact that human children, as a species, are reared in a variety of conditions. In order to flourish in these different niches, children must adopt different strategies. Play has been proffered as one way in which individuals gain this flexibility (Sutton-Smith, 1997). Thus, educators should beware of advice of one "royal road" to anything: There are numerous roads.

## References

- Bateson, P. P. G. (1976). Rules and reciprocity in behavioural development. In P. P. G. Bateson & R. A. Hinde (Eds.), *Growing points in ethology* (pp. 401–421). Cambridge, England: Cambridge University Press.
- Bekoff, M. (1995). Play signals as punctuation: The structure of social play in canids. *Behaviour*, *132*, 419–429.
- Blurton Jones, N. G. (1972). Categories of child interaction. In N. G. Blurton Jones (Ed.), *Ethological studies of child behavior* (pp. 97–129). London: Cambridge University Press.
- Boulton, M. J., & Smith, P.K. (1992). The social nature of play-fighting and play-chasing: Mechanisms and strategies underlying cooperation and compromise. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind* (pp. 429–444). New York: Oxford University Press.
- Byers, J. A., & Walker, C. (1995). Refining the motor training hypothesis for the evolution of play. *American Naturalist*, *146*, 25–40.
- Carson, J., Burks, V., & Parke, R. (1993). Parent-child physical play: Determinants and consequences. In K. MacDonald (Ed.), *Parent-child play* (pp. 197–220). Albany, NY: State University of New York Press.
- Charlesworth, W. R., & Dzur, C. (1987). Sex comparisons of preschoolers' behavior and resource utilization in group problem solving. *Child Development*, *58*, 191–200.
- Costabile, A., Smith, P. K., Matheson, L., Aston, J., Hunter, T., & Boulton, M. J. (1991). A cross-national comparison of how children distinguish serious and playful fighting. *Developmental Psychology*, *27*, 881–887.
- deWaal, F. B.M. (1985). The integration of dominance and social bonding in primates. *Quarterly Review of Biology*, *61*, 459–479.
- Dodge, K., & Frame, C. (1982). Social cognitive deficits and biases in aggressive boys. *Child Development*, *53*, 620–635.
- Fagen, R. (1981). *Animal play behavior*. New York: Oxford University Press.
- Fagot, B. I. (1994). Peer relations and the development of competence in boys and girls. In C. Leaper (Ed.), *Childhood sex segregation: Causes and consequences* (pp. 53–66). San Francisco: Jossey-Bass.
- Fry, D. P. (1987). Differences between play fighting and serious fighting among Zapotec children. *Ethology and Sociobiology*, *8*, 285–306.
- Garvey, C. (1990). *Play*. Cambridge, MA: Harvard University Press.
- Groos, K. (1901). *The play of man*. New York: Appleton.
- Hartup, W. W. (1996). The company they keep: Friendships and their developmental significance. *Child Development*, *67*, 1–13.
- Hinde, R. A. (1980). *Ethology*. London: Fontana.
- Humphreys, A. P., & Smith, P. K. (1984). Rough-and-tumble play in preschool and playground. In P. K. Smith (Ed.), *Play in animals and humans* (pp. 241–270). Oxford, England: Blackwell.
- Humphreys, A. P., & Smith, P. K. (1987). Rough-and-tumble play, friendship, and dominance in school children: Evidence for continuity and change with age. *Child Development*, *58*, 201–212.
- Jacklin, C. N., DiPietro, J. A., & Maccoby, E. E. (1984). Sex-typing behavior and sex-typing pressure in child/parent interaction. *Archives of Sexual Behavior*, *13*, 413–425.
- Konner, M. J. (1972). Aspects of the developmental ethology of a foraging people. In N. Blurton Jones (Ed), *Ethological studies of child behaviour* (pp. 285–304). London: Cambridge University Press.
- Maccoby, E. E. (1998). *The two sexes*. Cambridge, MA: Harvard University Press.

- MacDonald, K., & Parke, R. (1986). Parent-child physical play. *Sex Roles, 15*, 367-378.
- Martin, P. (1982). The energy costs of play: Definition and estimation. *Animal Behaviour, 30*, 294-295.
- Martin, P., & Caro, T. (1985). On the function of play and its role in behavioral development. In J. Rosenblatt, C. Beer, M. Bushnel, & P. Slater (Eds.), *Advances in the study of behavior, Vol. 15* (pp. 59-103). New York: Academic Press.
- McGrew, W. C. (1972). *An ecological study of children's behavior*. New York: Academic Press.
- Meaney, M. J., Stewart, J., & Beatty, W. W. (1985). Sex differences in social play. In J. Rosenblatt, C. Beer, M. C. Bushnel, & P. Slater (Eds.), *Advances in the study of behavior, Vol. 15* (pp. 2-58). New York: Academic Press.
- Neill, S. R. StJ. (1976). Aggressive and non-aggressive fighting in twelve-to-thirteen year old pre-adolescent boys. *Journal of Child Psychology and Psychiatry, 17*, 213-220.
- Oswald, H., Krappmann, L., Chowduri, F., & Salisch, M. (1987). Gaps and bridges: Interactions between girls and boys in elementary schools. *Sociological Studies of Child Development, 2*, 205-223.
- Parke, R. D., Cassidy, J., Burks, V., Carson, J., & Boyum, L. (1992). Familial contributions to peer competence among young children: The role of interactive and affective processes. In R. D. Parke & G. Ladd (Eds.), *Family-peer relationships* (pp. 107-134). Hillsdale, NJ: Erlbaum.
- Parke, R. D., & Suomi, S. J. (1981). Adult male infant relationships: Human and nonhuman primate evidence. In K. Immelman, G. W. Barlow, L. Petronovitch, & M. Main (Eds.), *Behavioral development* (pp. 700-725). Cambridge, England: Cambridge University Press.
- Pellegrini, A. D. (1988). Elementary school children's rough-and-tumble play and social competence. *Developmental Psychology, 24*, 802-806.
- Pellegrini, A. D. (1989a). Elementary school children's rough-and-tumble play. *Early Childhood Research Quarterly, 4*, 245-260.
- Pellegrini, A. D. (1989b). What is a category? The case of rough-and-tumble play. *Ethology and Sociobiology, 10*, 331-341.
- Pellegrini, A. D. (1993). Boys' rough-and-tumble play, social competence and group composition. *British Journal of Developmental Psychology, 11*, 237-248.
- Pellegrini, A. D. (1994). The rough play of adolescent boys of differing sociometric status. *International Journal of Behavioral Development, 17*, 525-540.
- Pellegrini, A. D. (1995a). *School recess and playground behavior*. Albany, NY: State University of New York Press.
- Pellegrini, A. D. (1995b). A longitudinal study of boys' rough-and-tumble play and dominance during early adolescence. *Journal of Applied Developmental Psychology, 16*, 77-93.
- Pellegrini, A. D., & Bartini, M. (2001). Dominance in early adolescent boys: Affiliative and aggressive dimensions and possible functions. *Merrill-Palmer Quarterly, 47*, 142-163.
- Pellegrini, A. D., Horvat, M., & Huberty, P. D. (1998). The relative cost of children's physical activity play. *Animal Behaviour, 55*, 1053-1061.
- Pellegrini, A. D., & Perlmutter, J. C. (1987). A re-examination of the Smilansky-Parten matrix of play behavior. *Journal of Research in Childhood Education, 2*, 89-96.
- Pellegrini, A. D., & Smith, P. K. (1998). Physical activity play: The nature and function of a neglected aspect of play. *Child Development, 69*, 577-598.
- Piaget, J. (1962). *Play, dreams, and imitation in childhood*. New York: Norton.
- Roopnarine, J. L., Hooper, F., Ahmeduzzaman, M., & Pollack, B. (1993). Gentle play partners: Mother-child and father-child play in New Delhi, India. In K. MacDonald (Ed.), *Parent-child play* (pp. 287-304). Albany, NY: State University of New York Press.
- Schafer, M., & Smith, P. K. (1996). Teachers' perceptions of play fighting and real fighting in primary school. *Educational Research, 38*, 173-181.

- Sluckin, A. M. (1981). *Growing up in the playground: The social development of children*. London: Routledge & Kegan Paul.
- Smith, P. K. (1982). Does play matter? Functional and evolutionary aspects of animal and human play. *Behavioral and Brain Sciences*, 5, 139–184.
- Smith, P. K., & Boulton, M. J. (1990). Rough-and-tumble play, aggression and dominance: Perception and behavior in children's encounters. *Human Development*, 33, 271–282.
- Smith, P. K., & Connolly, K. (1980). *The ecology of preschool behavior*. Cambridge, England: Cambridge University Press.
- Smith, P. K., Hunter, T., Carvalho, A., & Costabile, A. (1992). Children's perceptions of play-fighting, play-chasing and real fighting: A cross-national interview study. *Social Development*, 1, 211–229.
- Smith, P. K., & Lewis, K. (1985). Rough-and-tumble play, fighting, and chasing in nursery school children. *Ethology and Sociobiology*, 6, 175–181.
- Smith, P. K., Smees, R., Pellegrini, A. D., & Menesini, E. (1993, July). Play fighting and serious fighting: Perspectives on their relationship. Paper presented at the biennial meetings of the International Society for the Study of Behavioral Development, Recife, Brazil.
- Strayer, F. F. (1980). Social ecology of the preschool peer group. In W. A. Collins (Ed.), *The Minnesota symposia on child development, Vol. 13: Development of cognition, affect, and social relations* (pp. 165–196). Hillsdale, NJ: Erlbaum.
- Strayer, F. F., & Noel, J. M. (1986). The prosocial and antisocial functions of aggression: An ethological study of triadic conflict among young children. In C. Zahn-Waxler, E. M. Cummings, & R. Iannotti (Eds.), *Altruism and aggression* (pp. 107–131). New York: Academic Press.
- Sutton, J., Smith, P. K., & Swettenham, J. (1999). Socially undesirable need not be incompetent: A response to Crick and Dodge. *Social Development*, 8, 132–134.
- Sutton-Smith, B. (1997). *The ambiguity of play*. Cambridge, MA: Harvard University Press.
- Symons, D. (1978). *Play and aggression: A study of rhesus monkeys*. New York: Columbia University Press.
- Vaughn, B. E. (1999). Power is knowledge (and vice versa): A commentary on "Winning some and losing some: A social relations approach to social dominance in toddlers". *Merrill-Palmer Quarterly*, 45, 215–225.
- Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: Harvard University Press.
- Waters, E., & Sroufe, L. A. (1983). Social competence as a developmental construct. *Developmental Review*, 3, 79–97.

