



aggression [Carson et al., 1993; Paquette, 2004; Paquette et al., 2003b; Peterson and Flanders, 2005]. This study investigates the potential role of father–child RTP in the development of a child’s capacity to regulate aggression.

### **Play and Socialization**

It is well known that parent–child physical play is an important component of human socialization [Barth and Parke, 1993; Lindsey et al., 1997; MacDonald, 1993; MacDonald and Parke, 1984; Parke et al., 1988]. Sex differences appear to be the rule in this domain: boys engage in more RTP than their female counterparts in all cultures investigated to date [Pellegrini and Smith, 1998]. Yet, both boys and girls enjoy physical play over other types of play and fathers are the preferred play-mate [Ross and Taylor, 1989].

Fathers appear to socialize their children especially through physical play: father–child physical play is associated with peer competence [Carson and Parke, 1996; Lindsey et al., 1997; MacDonald and Parke, 1984]. Other studies have shown that this form of play is associated with emotion-regulation [Barth and Parke, 1993; Carson and Parke, 1996] and emotion-encoding skills [Carson and Parke, 1996; Parke et al., 1988], both of which are known to be related to peer competence [Field and Walden, 2008; Zeman et al., 2006]. The most popular children are those of fathers who exhibit high levels of physical play with both sons and daughters (3–4 years) and elicit high levels of positive feelings during play sessions [Corr et al., 1995]. Furthermore, children who experience greater difficulty in decoding emotions are less willing to engage in physical play with peers [Lewis and Thomas, 1990]. While the causal mechanisms have not been established, this body of research suggests that fathers can teach their children selfcontrol and sensitivity to others through play [Carson et al., 1993; Paquette et al., 2003a,b; Peterson and Flanders, 2005] and that these skills become important in the schoolyard when peers negotiate social rules among themselves through play [Pellegrini, 1995].

RTP is a specific form of physical play, characterized by aggressive behaviors such as wrestling, grappling, jumping, tumbling, and chasing, in a play context [Pellegrini and Smith, 1998]. The early research on RTP was done on nonhuman animals. The RTP of rats, hamsters, monkeys, and chimpanzees is fairly well-described [Chalmers, 1983; Paquette, 1994; Pellis and Pellis, 1987, 1988] and

studies have clearly established links between RTP and frontal-lobe functioning [Burgdorf et al., 2006; Panksepp et al., 2003; Pellis et al., 2005, 2006] and socialization, particularly in primates [Hughes, 1991; Millar, 1968]. Although adults often confuse RTP with genuine aggression [Scott and Panksepp, 2003], research has clearly distinguished these two types of behaviors [Jones, 1972] and demonstrated that they arise from two distinct motivational systems, one associated with affiliation and the other with competition [Panksepp, 1998a; Paquette, 1994; Pellis et al., 2005].

The frequency of father–child RTP peaks late in the preschool years. On average, when children reach 3–4 years of age, RTP accounts for roughly 8% of total parent–child interactions [Pellegrini and Smith, 1998]. Typically, this period is also important in the development of the selfregulatory functions of the frontal lobes [Séguin and Zelazo, 2005; Zelazo et al., 1997], especially, the ability to regulate aggressive behavior. Thus, RTP is a potentially important context for studying individual differences in father–child relationships and the impact of these differences on the development of aggressive behavior in children. Despite its potential importance, father–child RTP is surprisingly understudied [Panksepp et al., 2003], probably because many adults find it disruptive and dangerous [Panksepp, 1993], though this is true of many aspects of fatherhood.

### **Dominance in Dyadic Play**

Fathers tend to stimulate their children physically, emotionally, and cognitively during play. They also push them to take risks and reach for their physical, cognitive, and emotional limits [Paquette, 2004]. However, using their increased size, strength, and cognitive abilities, fathers can provide a secure environment for these interactions by asserting their authority and setting limits on their children’s behavior. These parental behaviors constitute an expression of dominance and are especially important for preschool aged children, whose selfregulation abilities are just starting to emerge, just as it is in the RTP of rat pups [Panksepp, 1998b], chimpanzees [Paquette, 1994], and preadolescent children [Pellegrini and Smith, 1998].

Traditionally, dominance has been defined by animal behaviorists in terms of group social hierarchy [Dunbar, 1988]. Dominance hierarchies emerge as a result of antagonistic dyadic confrontations among individual members of the group [Strayer and Strayer, 1978]. Thus, dominance is

achieved through coercive and aggressive confrontation. Defined in this way, dominance is not a common feature of the social life of human adults [Hawley, 1999]. In the human adult literature, social dominance in adults is typically seen as a personality dimension, referring to a coercive or aggressive interpersonal style [Moskowitz, 1993; Mudrack, 1993]. However, dominance in humans may be best defined in terms of a dyadic, affiliative relationship between individuals [Pellegrini et al., 2007], such that within a relationship one individual is more likely to have the upper hand with respect to access to resources or control over circumstances [Hawley, 1999]. Defined in this way, dominance is a highly relevant characteristic of human social behavior, and it is particularly easy to observe in young children [Hawley, 1999].

Children often use play interactions, especially RTP, to negotiate dominance among them [Pellegrini and Smith, 1998]. For example, during RTP, one individual typically has the upper hand, which may involve pinning, holding, pushing, or tickling. A child can assert dominance over a peer by using greater strength or “toughness” to hold the upper hand in RTP [Pellegrini and Smith, 1998]. In specific dyads, one child is more likely to hold this position than the other and stable patterns of dominance and submission within relationships emerge over time [Pellegrini and Smith, 1998]. This kind of physical prowess is typically important to a child’s social standing among peers at school [Pellegrini, 1995]. Similar dynamics operate in father–child play dyads as well, as each competes to hold the dominant position over the other. Because fathers are typically bigger and stronger, they typically get to decide whether and how much they allow their children to take the upper hand temporarily, with a behavior known as selfhandicapping [Pellegrini and Smith, 1998]. However, the degree to which a child is allowed to get the upper hand varies from dyad to dyad and this variability may be linked to the development of control over physical aggression in the child. Paquette [2004] proposed that children would learn selfregulatory strategies from RTP interactions in which their father is in control of play. Conversely, if children were allowed to dominate play and impose their will on their fathers, they would not learn social boundaries of their aggressive behavior and, as a result, be less skilled at selfregulating these behaviors over time.

### This Study

The aim of this study is to test that hypothesis. Among father–child play dyads in which the father

is more dominant, the frequency of RTP interactions should be associated with less aggressive behavior. Among dyads in which the father is less dominant, the frequency of RTP interactions should be associated with more physical aggression. We tested this hypothesis with 85 father–child dyads observed during a free-play session. Observational methods allowed for real-time description of dominance dynamics during play. Boys were expected to engage in more RTP and physical aggression than girls, but the relationship between RTP and aggression is hypothesized to be similar within each gender.

## METHODS

### Participants

A nonclinical sample of 85 father–child dyads was initially recruited to participate in the current project. Fathers were solicited to participate in a study of father–child play interactions with notices that were placed at the entrances of local community health centers in the province of Quebec, Canada. Recruitment was also done with ads in cafes and through word of mouth. Table I contains a summary of the characteristics of the sample. All the testing was conducted in French and all participants were either francophone or spoke French as a second language. Children (43 boys and 42 girls) were between the ages of 2 and 6 years (mean = 45.8 months, SD = 12.9 months). This age range was chosen because it corresponds with the period in which parent–child RTP activities are most common [Pellegrini and Smith, 1998]. All participants were treated in accordance with the ethical guidelines of the American Psychological Association’s Ethical Principles and Guidelines for the Protection of Human Subjects of Research [American Psychological Association, 2002]. Participants gave their consent to participate in the experiment and were compensated \$20.00 for their time.

### Materials

A digital camcorder was used to record play sessions between the fathers and their children. The Observer Video-Pro [Noldus et al., 2000], a specialized software for observational coding, was used to code the videos, from which the dominance measures were obtained. A series of questionnaires was used to assess the frequency and quality of

**TABLE I. Characteristics of the Sample**

Two biological parents	87.50%
Sex ratio (boys/girls)	43/42
Average age (years) of father (SD), range	33.6 (7.9) 20–55
Average age (years) of mother (SD), range	31.3 (7.2) 17–43
Average age (months) of children (SD), range	45.8 (12.9) 22–71
Average number of children (SD), range	1.7 (.8) 40.0%
Average number of years of schooling of father (SD), range	14.0 (3.3) 14
Average hours with child per week (SD), range	13.98 (6.1) 4.5–32.0
<i>Ethnicity of father</i>	
North American	80.3%
Latin American	7.9%
Haitian	5.3%
Other	6.6%
<i>Ethnicity of mother</i>	
North American	93.8%
Latin American	4.2%
Other	2.1%
<i>Fathers' schooling</i>	
12 years or less	32.50%
13–15 years	29.90%
16 years and more	35.10%
Fathers employed	78.70%
Mothers employed	65.00%
<i>Family income (\$Can)</i>	
0–39,999	33.30%
40–59,000	33.30%
60,000 and more	33.30%

father–child play activities, the behavior of the child, and the father’s parenting practices.

## Measures

**Play frequency.** The “Père-En-Jeux” questionnaire asks fathers to evaluate the frequency of various parenting behaviors with the following response options: “never,” “sometimes,” “regularly,” “often,” or “very often” [“jamais”, “à l’occasion”, “régulièrement”, “souvent”, or “très souvent”]. The item pertaining to RTP frequency was: “How often do you play fight with your child?” [Avez-vous l’occasion de jouer au jeu de bataille avec votre enfant?]. The item pertaining to play in general was: “How frequently do you play with your child” [À quelle fréquence jouez-vous avec lui?]. Previous research with this questionnaire has shown that the data retrieved by the “Père-En-Jeux” questionnaire is highly correlated with observational data [Paquette et al., 2003a]. Standardized scores for the continuous variables were used for the analyses.

**Physical aggression.** Physical aggression was assessed with the Behavior Questionnaire [Tremblay et al., 1992]. Fathers were asked to report on the frequency of physical aggression by responding “never or not true,” “sometimes or somewhat true,” “often or very true,” or “don’t know” to ten items, such as: “kicks others,” “physically attacks others,” “hits or punches others,” and “gets into fights.” The internal consistency for the scale was adequate (father:  $\alpha = .84$ ). Standardized scores for the continuous variables were used for the analyses.

**Father dominance.** The “Play Regulation Coding Scheme” (PRCS) was designed to describe the dominance relationship between child and father during play. It was adapted from a similar scheme designed to describe the quality of parent–child interactions [Kerns and Barth, 1995]. Every 10 sec during active play bouts, father–child dyads were given a “dominance” score based on behaviors and communications reflecting the degree to which the father controlled the flow of play or held the dominant position in relation to the child during that time frame. High scores were given to dyads in which the father controlled play (e.g. picking up or pinning a child in wrestling, being the aggressor in tickling or chasing). Lower scores were given to dyads in which the child had greater input into the flow of play (e.g. “daddy, it’s *my* turn to tickle *you*” or “let’s play the running game, we’ll start from here”) or the father allowed the child to take the upper hand (e.g. the child becomes the aggressor in tickling). Medium scores were given to dyads that shared the control of play circumstances and the dominant position (e.g. taking turns having the upper hand). The style of communication was also considered in this measure, with more directive communications (e.g. “Johnny, run over here and tackle me!”) getting a higher score than requests (e.g. “do you want to play horsey?”). Scores ranged from 0 to 4, where 0 = passive or submissive, 2 = shared, 4 = dominating or in charge, and 1 and 3 were midpoints between these anchors (mean = 3.08; SD = .55). A dominance score was computed for each dyad based on the mean of the ratings through the play episode.

It is important to note that the dyad’s level of dominance was assessed every 10 sec during all types of play interactions (e.g. RTP, nonphysical play, etc.). While RTP was widely observed in this sample, not all participants engaged in this form of play during the observation period. Therefore, the dominance scores are not an assessment of dominance during RTP, but a mean score of dominance ratings during play in general. We are working from

the assumption that the dominance dynamics during play in general apply to the RTP interactions about which the father reported on the “Père-En-Jeux” RTP frequency questionnaire item.

**Socio-demographics.** Basic socio-demographic characteristics of the families in the sample included the following:

- (a) *Age*: Fathers were asked to indicate their age in years and the age of their children in months.
- (b) *Family Income*: Fathers were asked to estimate the total annual income for their families. They had to choose from a series of response options ranging from “less than \$10,000” to “more than \$80,000.”
- (c) *Education*: Fathers were asked to indicate their last year of schooling completed.
- (d) *Time with child*: Fathers were asked to indicate how much time they spent alone with the target child, in hours during the week and on the weekend. A sum of the two reports was calculated and then standardized for use in the analyses.

## Procedure

Data collection took place in two stages. During the first in-home visit, after a period spent familiarizing the father–child dyad with the male assistant and the camera that had been set up in a corner of the living room, the dyad was filmed for a seven-minute free-play period with no toys. After the play session, fathers completed questionnaires on their socio-economic characteristics, and the “Père-en-jeux” questionnaire. During the second visit, six months later, fathers completed a questionnaire on their child’s social behaviors.

Research assistants visited the participating families in the homes. In a free-play context with no toys, the fathers were given the following directions: “Play the way you usually do with your child.” To ensure the ecological validity of the observations, the dyads were given ample time to adjust to the novel situation. The video camera was small and set up on a tripod as far from the dyad as possible. The research assistant was told to be as inconspicuous as possible during the observation. The fact that all but six participating dyads engaged in some play during the observation period supports the ecological validity as children tend not to play if they are uncomfortable or in novel surroundings [Millar, 1968]. The dyads were filmed for 7 min of

free play and the fathers were then asked to fill out the series of questionnaires. Only two fathers who were observed during play did not fill out the questionnaires. Once the visit was completed, the videos were coded using the PRCS in the “The Observer Video-Pro” software package.

## RESULTS

Verifications of the assumptions of normality, linearity, and homoscedasticity of residuals led to transformations of some variables to reduce skewness and reduce the number of outliers. Values that were three standard deviations from the mean were considered outliers. Two outliers were detected on the physical aggression measure and these were recoded to the next highest values. Logarithmic transformations were used on the measures of physical aggression and time spent with child. Standardized scores for the continuous variables were used for analyses.

### Validation of the Dominance Measure

Two research assistants coded the videos using the PRCS. They each coded half of the videos independently and in addition to another 20%, which they both coded for the purposes of evaluating inter-rater reliability. We used an intraclass correlation between the two sets of codes for the overlapping videos to calculate inter-rater reliability. Intraclass correlations are equivalent to weighed  $\kappa$  statistics, a common index of inter-rater reliability [Fleiss and Cohen, 1973]. The inter-rater reliability was adequate (intraclass correlation = .77,  $P < .01$ ). In cases where there was disagreement between the coders, an average of their two ratings was used in the final data set. Based on the model outlined above, a father who is less dominant during RTP was expected to have a child with greater physical aggression than a more dominant father. These associations were examined with Pearson correlations ( $N = 77$ ). The father dominance score was significantly negatively associated with physical aggression ( $r = -.35$ ,  $P < .01$ ) and RTP frequency ( $r = -.45$ ,  $P < .01$ ).

### Frequency of Father–Child RTP

The mean level of father–child RTP was 2.53 (SD = 1.21). According to the father reports on the questionnaire, boys (mean = 3.05; SD = 1.32) engaged in father–child RTP significantly more frequently than girls (mean = 2.02; SD = .84)

$t(83) = 4.23, P < .01$ . As a result, sex was included in the initial regression model. Data from only 77 of the 85 children were used in further analyses, because six dyads failed to initiate a single play bout of 10 sec or longer and two fathers did not answer the RTP frequency question. *T*-tests show that these eight dyads did not significantly differ from those included in the analyses on physical aggression child age, father age, father education, and family income.

### Relations Among Variables

Table II illustrates the correlations among the principal variables used in this study. Of note, father dominance was significantly negatively associated with RTP frequency, physical aggression, and age of the child, indicating that children with less dominating fathers tended to engage in more RTP with their fathers, were more aggressive in every-day life, and were older. RTP frequency was associated with physical aggression. This correlation suggests that aggressive children engage in more RTP with their fathers. However, we expect father dominance to moderate this effect. It is worth noting that RTP frequency was not associated with father age or socio-economic background, suggesting that RTP is common to all kinds of households.

### RTP, Dominance, and Physical Aggression

A sequential multiple regression was performed with physical aggression as the dependent variable and RTP frequency, father dominance, overall time spent with the child, and sex as independent variables.

In a first regression model, we examined if the expected relations would be moderated by child sex. Step 1 included the overall amount of time the father spent with his child. Step 2 included RTP frequency, father dominance, and sex. Step 3 included the

interactions between RTP frequency and dominance, RTP frequency and sex, and father dominance and sex. Step 4 included the three-way interaction between RTP frequency, dominance, and sex of the child.

The three-way interaction was not significant, nor were either of the two-way interactions involving sex, so a second model was run without sex (see Table III). Three significant predictors of physical aggression were detected in this reduced model. The main effect of time spent with child was significant  $\beta = -.22, t(76) = -2.11, P = .04$ , indicating that the more time the father spent with his child, the less aggressive his child was. The main effect of father dominance was significant  $\beta = -.27, t(76) = -2.26, P = .03$ , indicating that the more dominant the father was during play interactions, the less aggressive the child was in general. Finally, the interaction between RTP frequency and father dominance was also significant  $\beta = .29, t(76) = 2.70, P = .01$ .

The interaction was decomposed using a procedure outlined by Holmbeck [2002], following the recommendations of Aiken and West [1991]. The results suggest that, among the less dominant fathers, more frequent RTP was associated with higher levels of physical aggression in their children ( $t(73) = 2.06, P = .04$ ). Figure 1 illustrates the interaction effect graphically.

To test whether the relation of RTP to aggression was specific to RTP and not accounted for by a more general tendency of the father to play with the child, we added both the general play main effect and the general play by dominance interaction into the model. Neither effect was significant, suggesting that the central finding reported here is not accounted for by a general play effect.

The age of the children participating in the study ranges from approximately 2 to 6 years and children's capacity for selfcontrol typically changes through this period. As a consequence, the degree to which fathers control play may evolve as well and

**TABLE II. Correlations Among Principal Variables in the Model and Key Demographics**

	Father dominance	RTP frequency	Play frequency	Physical aggression	Child age	Father age	Father education	Family income
RTP frequency	***-.46	-						
Play frequency	.05	*.20	-					
Physical aggression	***-.34	** .28	-.02	-				
Child age	**-.26	.10	**-.26	.01	-			
Father age	.00	-.12	-.01	-.08	***.29	-		
Father education	-.08	.02	.13	.01	-.09	***.29	-	
Family income	-.11	.12	***.29	-.04	-.07	.17	** .27	-
Time with child	.10	-.05	-.02	-.24**	-.18	-.02	-.12	-.12

*Note.* Two-tailed Pearson correlations, \*Correlation is significant at the .10 level, \*\*Correlation is significant at the .05 level, \*\*\*Correlation is significant at the .01 level.

**TABLE III. Summary of Sequential Regression Analysis for Variables Predicting Physical Aggression ( $N = 77$ )**

Variables		$R^2$	$B$	SE $B$	$\beta$	$P$
Step 1		.05				
	Time with child		-.23	.12	-.22	.05
Step 2		.17				
	Time with child		-.20	.11	-.20	.07
	RTP frequency		.08	.12	.08	.51
	Dominance		-.30	.12	-.30	.02
Step 3		.25				
	Time with child		-.22	.11	-.22	.04
	RTP frequency		.05	.12	.05	.65
	Dominance		-.27	.12	-.26	.03
	RTP frequency $\times$ dominance		.23	.09	.29	.01

Note. Aggression father reports of the child's behavior on the NLSCY behavior questionnaire. RTP frequency, father's response to question 11 on the "Père-En-Jeux" questionnaire; Dominance, rating coding of the father's relative behavioral control in the video on a scale of 0 (passive) to 4 (dominating).

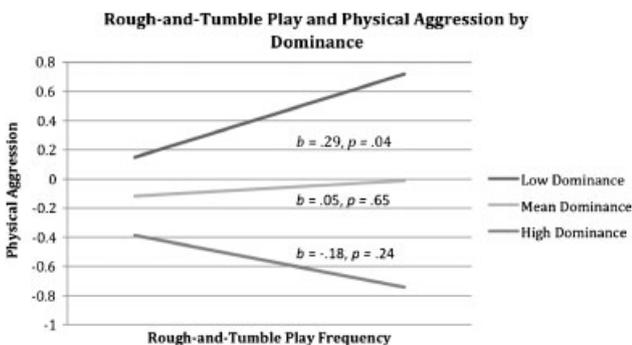


Fig. 1. The interaction of father dominance and father-child RTP frequency in predicting child physical aggression.

the importance of dominance in play may vary with the age of the child. To test the hypothesis that child age moderated the relationship between RTP, dominance, and aggression, the reduced model described above was rerun with a main effect of child age, the RTP-by-age and dominance-by-age two-way interactions, and the three-way interaction between RTP, age, and dominance. None of the effects including the age of the child were significant, indicating that the age of the child did not affect the relationship between RTP, dominance, and aggression.

## DISCUSSION

The main purpose of this study was to determine whether RTP between fathers and their young children is related to the children's ability to regulate physical aggression. It was hypothesized that,

among father-child dyads in which a father controls and sets limits during play, the frequency of RTP specifically would be associated with lower levels of physically aggressive behaviors in every-day life. The reverse should be the case among dyads in which fathers are less dominant playmates. We found that, indeed, dominance moderated the relationship between RTP and physical aggression. Children were more aggressive as a function of RTP but only if their fathers were relatively less dominant playmates.

The results of this study were maintained after controlling for several related variables. It has been widely observed that boys tend to be more aggressive [Maccoby and Jacklin, 1974] and engage in more RTP than girls [Pellegrini and Smith, 1998]. However, the results indicate that sex did not moderate the relationship between RTP and aggression, even though boys engaged in more RTP than girls. Complementary analyses showed that the age of the child and the overall amount of time the father spent with his child did not influence the findings. In addition, the observed relationship between RTP, dominance and aggression, was not accounted for by play in general. Overall, these results indicate that RTP activities can indeed be associated with behavior problems, as some adults believe [Panksepp, 1993], though these associations likely arise when fathers are unable to contain and impose limits on play interactions.

The current findings provide partial support for the theoretical models proposed by Paquette [2004] and Peterson and Flanders [2005]. Paquette argues that fathers can help their children learn to better manage their aggressive emotions through controlled confrontations in RTP. Peterson and Flanders [2005] proposed that RTP contributes more broadly to the development of selfregulation as it cultivates a child's identification with others. Because RTP is sustainable only as long as both participants enjoy themselves, children must learn to modulate their actions to maintain their fathers' enjoyment, even in the heat of the moment. These models are consistent with the literature indicating that father-child physical play is related to the child's social competencies with peers [Parke et al., 2002]. Furthermore, the frequency of these interactions peaks in the preschool years [Pellegrini and Smith, 1998], the period of significant change in a child's psychological and behavioral selfregulatory abilities in general [Séguin and Zelazo, 2005; Zelazo et al., 1997].

These findings have promising implications for the study of physical aggression. Physically aggressive

behavior in early childhood is a risk factor for the development of chronic psychopathology later in life [Moffitt et al., 1996]. The presence of a father figure in a child's life can protect children from these risks [Amato and Rezac, 1994], though as this study confirms, the quality of the father's influence is an important moderator [Jaffee et al., 2003]. In Addition, these results are consistent with the view that some degree of parental control reduces the risk of externalizing problems in children [Coley, 1998; Paquette, 2004]. The selfregulation deficit underlying physical aggression in children is difficult to treat [Frick, 2001], so strategies that help young children learn to regulate aggressive emotions are in demand and could become the basis for a treatment program for children with behavior problems [Lochman, 2006]. The current findings raise the possibility that improving the quality of father-child RTP could be a target of intervention with these kinds of children.

On the other hand, these findings seem to contrast with previous work suggesting that "horizontal" parent-child play interactions (i.e. interactions characterized by reciprocity and shared power) tend to provide children with the best opportunities to develop peer social competence [Russell et al., 1998]. For example, Lindsey and Mize [2000] had fathers and their children engage in toy-mediated physical play and showed that children from dyads high in mutual compliance—where partners tended to respond favorably to each other's initiations—tended to be more socially accepted at school. Although we did not assess mutual compliance, our results may be more consistent with those of another study by Barth and Parke [1993]. In that study, the authors showed that parent-child physical play interactions (which included some RTP behaviors), characterized by a controlling parent and a resisting child, or by a directing child, were negatively associated with adjustment to school entry. Like in our study, the resisting and directing children could be conceived as more dominant, relative to other children, in their father-child play interactions. Taken together, these studies suggest that an optimal power balance is likely to provide the best adaptive outcome.

For example, that father dominance during RTP specifically is more closely related to the development of selfregulatory abilities than dominance in other play contexts. Paquette [2004] specifically argues that optimal father-child RTP involves some degree of control by the father. RTP is an emotionally charged activity. Because preschool-aged children are just learning how to regulate their

own behavior, these interactions can be especially challenging. An optimally firm and assertive playmate is likely to be more important in this "hot" play context compared with "cooler" play contexts such as a board game. This hypothesis could be tested by examining the impact of dominance during several types of play interactions (including RTP) on the development of aggressive behavior.

### Limitations and Future Directions

This study has several limitations. First, the hypothesis tested is based on an assumption of socialization theory that father-child play affects the child's psychosocial development [MacDonald and Parke, 1984]. While the results reported here are consistent with this assumption, they are based on correlations and alternative accounts of the correlations are certainly possible. For example, temperamental characteristics of the children could influence the parents' responses during play [Kochanska, 1997]. Highly sociable children may elicit a more cooperative play style from parents [Russell et al., 1998]. Furthermore, aggressive children are known to have poor selfregulation abilities [Séguin et al., 2004; Séguin and Zelazo, 2005] and, as a result, they may be more difficult to contain and control during RTP, which would make the activity less enjoyable for more timid fathers. These alternative accounts could be addressed in future studies that control for these individual characteristics in longitudinal designs.

Whether RTP and dominance have a developmental impact on aggressive behavior could be addressed with a longitudinal study observing father-child RTP in the preschool years and psychosocial adjustment a few years later. There may be reasons to expect such an impact given the findings that parent-child physical play is known to be associated with later competence in peer interactions [MacDonald and Parke, 1984], and peer RTP, in particular, is known to be associated with social competence [Pellegrini, 1993], social skills [Pellegrini, 1992], and popularity [Pellegrini, 1994]. Nonetheless, the current findings warrant further research on the qualitative aspects of play and an understanding of how power dynamics during play evolve over time. It may be critical to know, for example, that RTP is helpful to some physically aggressive children under certain conditions and harmful to other aggressive children under different conditions.

A second limitation of this study is related to the specificity of the hypothesized effect of RTP on physical aggression. The theoretical models reviewed

here suggest that RTP has a unique impact on the development of physically aggressive behavior. However, this specificity of RTP to physical aggression cannot be definitively established with the current data. The dominance data were collected from in-home observations of dominance during various types of play interactions, including RTP. We assumed that the dominance dynamics observed during play in general applied to these RTP interactions. We adopted this approach to maximize the ecological validity of the study design, reasoning that it would be awkward to tell fathers and children when and how to play specific games. However, we only collected frequency data about RTP and not other specific types of play, so we could not compare the interaction of dominance and RTP to the interaction of dominance with other specific play types in predicting aggression. Nonetheless, we were able to generate some support for the specificity of RTP assumption, by demonstrating that the observed interaction between RTP and dominance in predicting physical aggression was maintained after controlling for the frequency of play in general. A follow-up study might have participants to engage in various specific play interactions. While this may be less ecologically valid, these data would shed some light on the specificity of RTP proposed here.

Third, it is worth noting that the current conceptualizations of aggression and the regulation thereof are probably more pertinent to some forms of aggression than others. However, this study employed a basic empirical measure of physical aggression: father-reported frequency of specific physically aggressive acts. This measure does not take the motivation or cause of the behavior into account, even though the regulation of these two types of behaviors is likely to be different. Researchers often distinguish between two broad categories of aggression [Dodge, 1991], proactive and reactive [Dodge et al., 1997; Vitiello and Stoff, 1997]. Within this framework, it is possible that father-child RTP is more closely related to the regulation of reactive aggression because RTP tends to be a physiologically arousing activity. Future studies could address this issue with more detailed assessment of aggressive behavior, including perhaps other forms of aggression such as proactive, reactive, or social aggression.

Fourth, caution is warranted in the generalization of the current results because of a potential self-selection bias. The fathers who participated in the study were volunteers who answered notices posted in community health centers and local cafés. The sample was slightly older and more educated than

would be expected in a randomly selected sample of 2- to 6-year-old children.

Finally, future studies may also include a more sophisticated measure of RTP frequency. This study used a single, self-report questionnaire item about play fighting. Play fighting is merely one type of RTP and future measures may target other types in addition. This future measure could also include objective time anchors for the frequency of play to improve the validity of the data. Furthermore, because RTP is often misconstrued by adults as dangerous or violent, respondents may have tended toward more socially desirable answers. This limitation could be resolved with questions about different aspects of RTP as well as the respondents' attitudes toward the activity. Finally, soliciting another member of the household, such as the child's mother, for information about father-child play frequency and quality will allow for a multi-source assessment of RTP and improve the reliability of the construct.

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#### REFERENCES

- Aiken LS, West SG. 1991. Multiple Regression: Testing and Interpreting Interactions. London: Sage Publications.
- Amato PR, Rezac SJ. 1994. Contact with nonresidential parents, interparental conflict, and children's behavior. *J Fam Issues* 15:191-207.
- American Psychological Association. 2002. Ethical Principles of Psychologists and Code of Conduct. Washington: American Psychological Association.
- Barth JM, Parke RD. 1993. Parent-child relationship influences on children's transition to school. *Merrill-Palmer Q J Dev Psychol* 39:173-195.
- Bongers IL, Koot HM, van der Ende J, Verhulst FC. 2004. Developmental trajectories of externalizing behaviors in childhood and adolescence. *Child Dev* 75:1523-1537.
- Broidy L, Nagin DS, Tremblay RE, Bates JE, Brame R, Dodge KA, Fergusson DM, Horwood J, Loeber R, Laird R, Lynam DR, Moffitt TE, Pettit GS, Vitaro F. 2003. Developmental trajectories of childhood disruptive behaviors and adolescent delinquency: six site, cross-national study. *Dev Psychol* 39:222-245.
- Burgdorf J, Panksepp J, Beinfeld MC, Kroes RA, Moskal JR. 2006. Regional brain cholecystokinin changes as a function of rough-and-tumble play behavior in adolescent rats. *Peptides* 27:172-177.
- Carson JL, Parke RD. 1996. Reciprocal negative affect in parent-child interactions and children's peer competency. *Child Dev* 67:2226.

- Carson J, Burks V, Parke RD. 1993. Parent-child physical play: Determinants and consequences. In: MacDonald K (ed). *Children's Play in Society*. Albany, NY: State University of New York Press. p 197-220.
- Chalmers N. 1983. The development of social relationships. In: Halliday TR, Slater PJB (eds). *Animal Behaviour*, Vol. 3. Genes, Development and Learning. Oxford: Blackwell Scientific Publications. p 114-148.
- Coley RL. 1998. Children's socialization experiences and functioning in single-mother households: The importance of fathers and other men. *Child Dev* 69:219-230.
- Connor DF, Carlson GA, Chang KD, Daniolos PT, Ferziger R, Findling RL, Hutchinson JG, Malone RP, Halperin JM, Plattner B, Post RM, Reynolds DL, Rogers KM, Saxena K, Steiner H. 2006. Juvenile maladaptive aggression: A review of prevention, treatment, and service configuration and a proposed research agenda. *J Clin Psychiatry* 67:808-820.
- Corr PJ, Pickering AD, Gray JA. 1995. Personality and reinforcement in associative and instrumental learning. *Pers Individ Differences* 19:47-71.
- Dodge KA. 1991. The structure and function of reactive and proactive aggression. In: Pepler DJ, Rubin KH (eds). *The Development and Treatment of Childhood Aggression*. Hillsdale, NJ: Lawrence Erlbaum Associates. p 201-219.
- Dodge KA, Lochman JE, Harnish JD, Bates JE, Pettit GS. 1997. Reactive and proactive aggression in school children and psychiatrically impaired chronically assaultive youth. *J Abnorm Psychol* 106:37-51.
- Dunbar RM. 1988. *Primate Social Systems*. Ithaca, NY: Cornell University Press; and London: Chapman & Hall.
- Field TM, Walden TA. 2008. Production and discrimination of facial expressions by preschool children. *Child Dev* 53: 1299-1311.
- Fleiss JL, Cohen J. 1973. The equivalence of weighted kappa and the intraclass correlation coefficient as measures of reliability. *Educ Psychol Meas* 33:613-619.
- Frick PJ. 2001. Effective interventions for children and adolescents with conduct disorder. *Can J Psychiatry* 46:597-608.
- Hawley PH. 1999. The ontogenesis of social dominance: strategy-based evolutionary perspective. *Dev Rev* 19:97-132.
- Holmbeck GN. 2002. Post-hoc probing of significant moderational and mediational effects in studies of pediatric populations. *J Pediatr Psychol* 27:96.
- Hughes FP. 1991. *Children, Play, and Development*. Needham Heights, MA: Allyn Bacon.
- Jaffee SR, Moffitt TE, Caspi A, Taylor A. 2003. Life with (or without) father: The benefits of living with two biological parents depend on the father's antisocial behavior. *Child Dev* 74:109-126.
- Jones NB. 1972. *Ethological Studies of Child Behaviour*. Oxford, England: Cambridge University Press.
- Kochanska G. 1997. Multiple pathways to conscience for children with different temperaments: From toddlerhood to age 5. [References]. *Dev Psychol* 33:228-240.
- Lewis M, Thomas D. 1990. Cortisol release in infants in response to inoculation. *Child Dev* 61:50-59.
- Lindsey EW, Mize J. 2000. Parent-child physical and pretense play: Links to children's social competence. *Merrill-Palmer Q J Dev Psychol* 46:565-591.
- Lindsey EW, Mize J, Pettit GS. 1997. Mutuality in parent-child play: Consequences for children's peer competence. *J Soc Pers Relat* 14:523-538.
- Lochman JE. 2006. Translation of research into interventions. *Int J Behav Dev* 30:31-38.
- Lochman JE, Salekin RT. 2003. Introduction—Prevention and intervention with aggressive and disruptive children: Next steps in behavioral intervention research. *Behav Ther* 34:413-419.
- Loeber R, Hay D. 1997. Key issues in the development of aggression and violence from childhood to early adulthood. *Annu Rev Psychol* 48:371-410.
- Maccoby EE, Jacklin CN. 1974. *The Psychology of Sex Differences*. Stanford, CA: Stanford University Press.
- MacDonald K. 1993. *Parent-Child Play: Descriptions and Implications*. Albany, NY: State University of New York Press.
- MacDonald K, Parke RD. 1984. Bridging the gap—Parent-child play interaction and peer interactive competence. *Child Dev* 55:1265-1277.
- Millar S. 1968. *The Psychology of Play*. Harmondsworth: Penguin Books.
- Moffitt TE, Caspi A, Dickson N, Silva P, Stanton W. 1996. Childhood-onset versus adolescent-onset antisocial conduct problems in males: Natural history from ages 3 to 18 years. *Dev Psychopathol* 8:399-424.
- Moskowitz DS. 1993. Dominance and friendliness—On the interaction of gender and situation. *J Pers* 61:387-409.
- Mudrack PE. 1993. Relationship between dominance and achievement among self-report measures. *Psychol Rep* 73:971-977.
- NICHD Early Child Care Research Network. 2004. Trajectories of physical aggression from toddlerhood to middle childhood: Predictors, correlates, and outcomes. *Monogr Soc Res Child Dev* 69:vii-128.
- Noldus LPJJ, Trienes RJH, Hendriksen AHM, Jansen H, Jansen RG. 2000. The Observer Video-Pro: New software for the collection, management, and presentation of time-structured data from videotapes and digital media files. *Behav Res Methods Instrum Comput* 32:197-206.
- Panksepp J. 1993. Rough and tumble play: A fundamental brain process. In: MacDonald K (ed). *Parent-Child Play: Descriptions and Implications*. Albany, NY: State University of New York Press. p 147-184.
- Panksepp J. 1998a. *Affective Neuroscience: The Foundations of Human and Animal Emotions*. New York: Oxford.
- Panksepp J. 1998b. Attention deficit hyperactivity disorders, psychostimulants, and intolerance of childhood playfulness: A tragedy in the making? *Curr Dir Psychol Sci* 7:91-98.
- Panksepp J, Burgdorf J, Turner C, Gordon N. 2003. Modeling ADHD-type arousal with unilateral frontal cortex damage in rats and beneficial effects of play therapy. *Brain Cogn* 52: 97-105.
- Paquette D. 1994. Fighting and playfighting in captive adolescent chimpanzees. *Aggr Behav* 20:49-65.
- Paquette D. 2004. Theorizing the father-child relationship: Mechanisms and developmental outcomes. *Hum Dev* 47:193-219.
- Paquette D, Bigras M, Dubeau D. 2003a. Father-child Rough-and-Tumble Play and non-aggressive competition in preschool children. Presented at the XIth European Conference on Developmental Psychology, Milan, Italy.
- Paquette D, Carbonneau R, Dubeau D, Bigras M, Tremblay RE. 2003b. Prevalence of father-child rough-and-tumble play and physical aggression in preschool children. *Eur J Psychol Educ* 18:171-189.
- Parke RD, MacDonald K, Beitel A, Bhavnagri N. 1988. The role of the family in the development of peer relationships. In: Peters RD, McMahan RJ (eds). *Social Learning and Systems Approaches to Marriage and the Family*. Philadelphia: Brunner/Mazel. p 17-44.
- Parke RD, Kim M, Killan C, Dennis J, Flyr ML, Wild MN. 2002. Fathers' contributions to children's peer relationships. In: Tamis-

- LeMonda CS, Cabrera N (eds). Handbook of Father Involvement: Multidisciplinary Perspectives. New Jersey: LEA. p 141–167.
- Pellegrini AD. 1992. Rough-and-tumble play and social problem solving flexibility. *Creativity Res J* 5:13–26.
- Pellegrini AD. 1993. Boys' rough-and-tumble play, social competence and group composition. *Br J Dev Psychol* 11:237–248.
- Pellegrini AD. 1994. The rough play of adolescent boys of differing sociometric status. *Int J Behav Dev* 17:525–540.
- Pellegrini AD. 1995. A longitudinal study of boys' rough-and-tumble play and dominance during early adolescence. *J Appl Dev Psychol* 16:77–93.
- Pellegrini AD, Roseth CJ, Mliner S, Bohn CM, Van Ryzin M, Vance N, Cheatham CL, Tarullo A. 2007. Social dominance in preschool classrooms. *J Comp Psychol* 121:54–64.
- Pellis SM, Pellis VC. 1987. Play-fighting differs from serious fighting in both target of attack and tactics of fighting in the laboratory rat *Rattus norvegicus*. *Aggr Behav* 13:227–242.
- Pellis SM, Pellis VC. 1988. Play-fighting in the Syrian golden hamster *Mesocricetus auratus* Waterhouse, and its relationship to serious fighting during postweaning development. *Dev Psychobiol* 21:323–337.
- Pellis SM, Pellis VC, Foroud A. 2005. Play fighting: aggression, affiliation, and the development of nuanced social skills. In: Tremblay RE, Hartup WW, Archer J (eds). *Developmental Origins of Aggression*. New York: Guilford Press. p 47–62.
- Pellis SM, Hastings E, Shimizu T, Kamitakahara H, Komorowska J, Forgie ML, Kolb B. 2006. The effects of orbital frontal cortex damage on the modulation of defensive responses by rats in playful and nonplayful social contexts. *Behav Neurosci* 120:72–84.
- Peterson JB, Flanders JL. 2005. Play and the regulation of aggression. In: Tremblay RE, Hartup WW, Archer J (eds). *Developmental Origins of Aggression*. New York: Guilford Press. p 133–157.
- Ross H, Taylor H. 1989. Do boys prefer daddy or his physical style of play? *Sex Roles* 20:23–33.
- Russell A, Pettit GS, Mize J. 1998. Horizontal qualities in parent–child relationships: Parallels with and possible consequences for children's peer relationships. *Dev Rev* 18:313–352.
- Rutter M. 1996. Connections between child and adult psychopathology. *Eur Child Adolesc Psychiatry* 5:4–7.
- Sanders MR, Marie-Dadds C, Tully LA, Bor W. 2000. The Triple P-positive parenting program: A comparison of enhanced, standard, and self-directed behavioral family intervention for parents of children with early onset conduct problems. *J Consult Clin Psychol* 68:624–640.
- Scott E, Panksepp J. 2003. Rough-and-tumble play in human children. *Aggr Behav* 29:539–551.
- Séguin JR, Zelazo PD. 2005. Executive function in early physical aggression. In: Tremblay RE, Hartup WW, Archer J (eds). *Developmental Origins of Aggression*. New York, NY: Guilford Press. p 307–329.
- Séguin JR, Nagin DS, Assaad JM, Tremblay RE. 2004. Cognitive-neuropsychological function in chronic physical aggression and hyperactivity. *J Abnorm Psychol* 113:603–613.
- Strayer J, Strayer FF. 1978. Social aggression and power relations among preschool-children. *Aggr Behav* 4:173–182.
- Tremblay RE, Vitaro F, Gagnon C, Piché C, Royer N. 1992. A prosocial scale for the preschool behaviour questionnaire: Concurrent and predictive correlates. *Int J Behav Dev* 15:227–245.
- Tremblay RE, Japel C, Pérusse D, Boivin M, Zoccolillo M, Montplaisir J. 1999. The search for the age of “onset” of physical aggression: Rousseau and Bandura revisited. *Crim Behav Ment Health* 9:24–39.
- Tremblay RE, Nagin DS, Seguin JR, Zoccolillo M, Zelazo PD, Boivin M, Pérusse D, Japel C. 2004. Physical aggression during early childhood: Trajectories and predictors. *Pediatrics* 114:E43–E50.
- Vitiello B, Stoff DM. 1997. Subtypes of aggression and their relevance to child psychiatry. *J Am Acad Child Adolesc Psychiatry* 36:307–315.
- Zelazo PD, Carter A, Reznick JS, Frye D. 1997. Early development of executive function: A problem-solving framework. *Rev Gen Psychol* 1:198–226.
- Zeman J, Cassano M, Perry-Parrish C, Stegall S. 2006. Emotion regulation in children and adolescents. *J Dev Behav Pediatr* 27:155–168.