doi: 10.1111/j.1467-9507.2011.00617.x

Effects of a Punitive Environment on Children's Executive Functioning: A Natural Experiment

Victoria Talwar, *McGill University*, Stephanie M. Carlson, *University of Minnesota* and Kang Lee, *University of Toronto*

Abstract

Few studies have examined the influence of environmental factors on children's executive functioning (EF) performance. The present study examined the effects of a punitive vs. non-punitive school environment on West African children's EF skills. Tasks included a 'cool' (relatively non-affective) and 'hot' (relatively affective/motivational) version of three EF tasks: delay of gratification; gift delay; and dimensional change card sort. Children had more difficulties with the hot versions of the tasks than the cool versions, and older children outperformed younger children. After controlling for verbal ability (Peabody picture vocabulary test-third edition), a consistent pattern of interaction between school and grade level emerged. Overall, kindergarten children in the punitive school performed no differently than their counterparts in the non-punitive school. However, in grade 1, children in the punitive school performed significantly worse than their counterparts in the non-punitive school. These results point to the need to consider interactions among discipline style, age, and internalization processes of self-regulation to better understand environmental influences on EF development.

Keywords: corporal punishment; executive functioning; discipline style; self-regulation

Introduction

Executive functioning (EF) is a domain-general cognitive construct that encompasses a variety of subfunctions (e.g., inhibition, working memory, and set-shifting) defined in terms of their common outcome of goal-directed problem solving (for a review, see Zelazo, Carlson, & Kesek, 2008). Changes in EF are recognized as playing a critical role in cognitive and social development (Carlson & Moses, 2001; Hughes, 1998; Kochanska, Murray, & Harlan, 2000). Research has found that there are important developments in EF between 2 and 5 years of age, and that adult-level abilities are reached on some EF tasks by 12 years whereas other EF abilities develop well into adulthood (Carlson, 2005; Zelazo & Müller, 2002).

Correspondence should be addressed to Victoria Talwar, Department of Educational and Counselling Psychology, McGill University, 3700 McTavish, Montreal, QC, Canada H3A 1Y2. E-mail: *victoria.talwar@mcgill.ca* or Kang Lee, Dr. Eric Jackman Institute of Child study, University of Toronto, 45 Walmer Road, Toronto, Canada M5R 2X2. E-mail: *kang.lee@utoronto.ca*

Despite its importance, surprisingly little is known about the role of children's social environment on the development of EF. Research on self-control has suggested that social influences such as family factors, neighborhood conditions, and the school context are implicated (Burt, Simons, & Simons, 2006; Cole & Mitchell, 2000; Hay, 2001; Lengua, Honorado, & Bush, 2007; Morrell & Murray, 2003; Turner, Piquero, & Pratt, 2005).

The impact of environmental factors—particularly discipline practices—on children's EF abilities is important given the relation between deficient EF and behavioral problems (Barkley, 1997; Clark, Prior, & Kinsella, 2002; Eisenberg, Chang, Ma, & Huang, 2009; Hughes & Ensor, 2006; Rubia et al., 2001), as well as their social relations with family and peers (Coplan, Hastings, Lagace-Sequin, & Moulton, 2002; Hughes & Ensor; Scaramella & Leve, 2004). However, whereas some theorists argue that harsh punishment can lead to behavioral problems and delinquency (Gershoff, 2002; Straus, Sugarman, & Giles-Sims, 1997), others dispute whether corporal punishment is associated with negative outcomes in children's behavior (e.g., Baumrind, 1997; Larzelere, 2000). As self-regulation is an important predictor of internalization of social rules and moral standards (Eisenberg, 2000; Kochanska, 2002; Kochanska, Coy, & Murray, 2001) and EF is linked to broader cognitive functioning and school achievement (e.g., Bull & Scerif, 2001), it is important to examine the impact of social factors on its development in children. The current study, using a quasi-experimental design, examines the influence of a punitive harsh school environment on children's EF abilities. Children from two West African schools that differed in the type of disciplinary practice used were tested on their ability to perform both 'hot' (affective, emotionally arousing) and 'cool' (abstract) EF tasks.

Socialization and Self-regulation

The literature regarding the effects of corporal punishment reflects an age-old debate spanning from John Locke (1693/1909–1914) and Jean Jacques Rousseau (1762/1979) to current controversy in academic and popular press over the use of coercive punitive methods vs. positive reinforcement and inductive discipline to achieve child compliance (e.g., Baumrind, 1996; Gershoff, 2002; Straus, 1999). For instance, authoritarian parenting, characterized by harsh physical and/or verbal punishment, has been shown to have detrimental effects on children's social–cognitive performance and behaviors (Baumrind, 1991; Patterson, Reid, & Dishion, 1992). Research on parenting styles has suggested that negative controlling strategies that are power assertive undermine the emerging internalization and self-regulation of the child (Kochanska & Aksan, 1995; Silverman & Ragusa, 1990). It has been suggested that parents who are more authoritarian may develop an information processing schema that makes constructs of blame and competence very accessible and they process information in terms of this schema (Dix, Ruble, & Zambarabo, 1989). As a result, authoritarian adults may attribute children's acting out or rule violations to internal causes (e.g., willful disregard, incompetence) and be less focused on empathy-related goals (Coplan et al., 2002). Such adults are likely to administer aversive punishments rather than provide guidance to the child that would help the child master the goal or behavior in question. In turn, punitive discipline may increase children's arousal, thereby impeding their efforts to learn competent and autonomous regulation (Scaramella & Leve, 2004). Thus, power-assertive control models and promotes inappropriate regulatory behaviors which focus

on arousing stimuli and fail to provide children with opportunities for developing self-regulation.

In support of this framework, Karreman, van Tuijl, van Aken, and Dekovic (2006) carried out a meta-analysis and found that positive parental control was positively associated with children's self-regulation whereas negative parental control was associated with poor self-regulation. Similarly, Eisenberg et al. (2009) found that authoritative parenting and low corporal punishment in the home resulted in high effortful control in Chinese children whereas use of corporal punishment was negatively related to effortful control. Overall, findings have been consistent across cultures on the relation between authoritative and punitive parenting and children's self-regulation (e.g., Rudy & Grusec, 2006; Zhou, Eisenberg, Wang, & Reiser, 2004).

Other research examining the effects of corporal punishment has suggested that a harsh punitive environment can have adverse effects on children's cognitive development (Bee et al., 1982; Hess & McDevitt, 1984). For instance, Smith and Brooks-Gunn (1997) found that children who experienced harsh parental discipline had lower IQs even after controlling for a range of child and parent factors. Most recently, Straus and Paschall (2009) reported a 4-year longitudinal study showing that corporal punishment in the home was associated with decreases in children's general cognitive ability scores over time. More specific aspects of cognitive functioning that are closely related to self-regulation (i.e., hot and cool EF) were not examined.

Thus, it has been suggested that exposure to harsh disciplinary punishment may affect children's self-regulation and cognitive development; however, the processes by which this may occur are not clear. It may lead to decreases in children's cognitive ability due to an over-reliance by adults on power-assertive discipline and less inductive methods of behavioral control that foster internalization of standards and problem solving. Additionally, harsh punitive discipline may affect cognitive development in children through the affective stress-related responses it elicits. Stress can adversely affect cognitive functioning, leading to cognitive errors and diminished processing capacity (Heuer & Reisberg, 1992; Perry, 2006).

On the other hand, some previous research has instead suggested that children raised in an environment that uses harsh corporal punishment may learn to suppress impulsive behavior longer than other children, perhaps due to their strong desire to avoid severe punishments (Coplan et al., 2002; Hastings & Grusec, 1998; Scaramella & Leve, 2004). Others have found that negative intrusive control can paradoxically lead to higher levels of inhibition in children (Belsky, Rha, & Park, 2000; Chen et al., 1998) and positive parental control is associated with lower levels of inhibition and delay of gratification in some studies (Chen et al. 1998; Putnam, Spritz, & Stifter, 2002; Silverman & Ragusa, 1990). Further studies suggest that corporal punishment leads to more immediate compliance and suppression of undesirable behavior in children (for review see Gershoff, 2002).

Hence, in addition to considerable historical and societal debates over the practice of corporal punishment, research evidence regarding its relation to self-regulation leaves many questions unanswered. For example, is punitive discipline related to both 'hot' and 'cool' EF, as suggested by separate sets of studies that have examined these aspects of self-regulation? Furthermore, little is known about the effects of corporal punishment in other environments outside the home, such as school, and yet educators increasingly consider competent EF to be vital for controlling impulses, attention, and emotions—skills relevant to classroom success apart from IQ (e.g., Blair & Diamond, 2008). Lastly, very few studies have examined the dose-response relation between

punitive discipline and behavioral and cognitive outcomes, even though the duration of exposure would seem to be a key variable to help disentangle these apparently contradictory findings as to whether it helps or hinders the development of self-regulation.

Current Study

One reason there has been little research to examine the effects of disciplinary practices on EF ability is that it is unethical to test these effects experimentally; one cannot randomly assign children to a punitive vs. non-punitive environment to establish a causal relation between punitive environment and EF. However, one could use a quasi-experimental design to address this question by capitalizing on naturally occurring situations in which children are exposed to punitive or non-punitive discipline. Here, we report data from such situations. We tested children from families of similar socioeconomic status who were enrolled in one of two similar private schools, located in the same geographic region, but differing in the type of disciplinary practice they used. The study was conducted in a West African country where, although the government has outlawed punitive discipline methods in the public schools, some private schools continue to endorse a traditional punitive discipline model that is authoritarian in style whereas others reject such models, favoring the use of child management techniques that focus on positive reinforcement (Tafa, 2002).

Among the two groups of children we tested, one group was enrolled in a private school that used a strict traditional authoritarian discipline model (henceforth referred to as the 'punitive school'). Discipline in the form of beating with a stick, slapping of the head, and pinching was administered publicly and routinely for offenses ranging from forgetting a pencil or academic underachievement, to being disruptive in class (based on daily observation, school records, and school officials' reports). The educational philosophy of this school is that children need reinforcement in order to learn and punitive discipline effectively teaches children not to misbehave so that learning will occur. In the other school, also private (henceforth referred to as the 'non-punitive school'), children were disciplined for similar offenses with the use of time-outs, verbal reprimands, and for more serious offenses children were taken to the principal's office for reprimand. The philosophy of this school is to encourage children's academic achievement and socially desirable behavior through positive reinforcement.

This situation provided a unique opportunity to conduct a natural experiment to examine the impact of punitive vs. non-punitive environments on young children's EF abilities. Based on limited research on the effects of discipline practices on children's cognitive performance, our primary hypothesis was that children from the punitive school would have poorer EF performance than the children from the non-punitive school. Furthermore, we included a more general measure of children's cognitive verbal ability using the Peabody picture vocabulary test-third edition (PPVT-III). It was expected that children from the punitive school would have lower PPVT-III scores and lower scores on the three measures of EF included in this study (delay of gratification, gift delay and the dimensional card sort task), but that EF differences would persist even after controlling for PPVT-III scores.

Furthermore, as we alluded to earlier, recent treatments of EF in children suggest the possibility of a distinction between 'hot' (affectively sensitive) and 'cool' (affectively neutral) aspects of EF (Zelazo & Müller, 2002). Cool EF is elicited by abstract,

decontextualized problems, and is associated with dorsolateral regions of the prefrontal cortex (PFC) whereas hot EF is elicited by problems that involve the regulation of affect and motivation, most often associated with ventral medial regions of PFC (e.g., Bechara, Damasio, Damasio, & Lee, 1999). Recent investigations suggest that younger children may have greater difficulties inhibiting their responses in the face of 'hot' stimuli (Carlson, Davis, & Leach, 2005; Garon & Moore, 2004; Hongwanishkul, Happaney, Lee, & Zelazo, 2005; Kerr & Zelazo, 2004). However, empirical evidence on the development of children's hot EF and its relation to cool EF is limited. Some research has shown that impulse control and delay of gratification (associated with hot EF) are adversely affected by family dysfunction, including harsh parenting (Hughes & Ensor, 2006). As well, receiving desirable rewards has been shown to affect children's motivation and forestall their self-regulation (Deci, Koestner, & Ryan, 1999). Thus, school-based disciplinary practices emphasizing reward and punishment might be especially likely to affect children's performance on hot, as opposed to cool, EF measures. Therefore, in addition to our primary hypothesis that children from the punitive school would have poorer EF performance than children from the non-punitive school, we predicted that there might be an interaction between hot and cool EF tasks and school environment, wherein the difference between the punitive and non-punitive school children would be more pronounced for the hot rather than the cool EF tasks. To test this interaction hypothesis, we included both relatively hot and cool versions of each of three EF tasks in the current study.

Finally, we predicted a dosage-response relation in which children who had been exposed to harsh punitive discipline for a longer period of time would exhibit greater costs to EF ability. This prediction was tested by including children of two grade levels (kindergarten and grade 1) at each of the schools.

Method

Participants

Sixty-three children between 3 and 6 years of age from two West African private schools were recruited. Their families lived in the same urban neighborhood and their parents were largely civil servants, professionals, and merchants. The majority was ethnically Ewe and spoke both French and Ewe languages. Children spoke primarily French in their schools and the lessons were conducted in French. Thirty-six children attended the punitive school: 19 kindergartners (M = 4.47 years; SD = .52; 13 boys, range = 3.90 to 5.04 years) and 17 grade 1 children (M = 6.30 years; SD = .47; eight boys, range = 5.09 to 6.10 years). Twenty-seven children attended the non-punitive school: 13 kindergartners (M = 4.42 years; SD = .38; six boys; range = 3.10 to 5.04 years) and 14 grade 1 children (M = 6.50 years, SD = .52; six boys; range = 5.10 to 6.11 years). Children were recruited at the end of the school year. Informed consent was obtained from the children's parent or legal guardian.

School Characteristics. The schools were two of several private schools in the same city that served parents with similar socioeconomic backgrounds in the region. Specific income levels of families were not available; however, both schools served children of wealthy families who could pay the school fees. Both schools were secular and did not include religious instruction. Both schools emphasized academics for their students. In addition to the choice of discipline style, the two schools also differed in

size; the non-punitive school had approximately 250 students in the elementary school whereas the punitive school had approximately 350 students enrolled in the elementary school. The punitive school also had a secondary school attached to it whereas the non-punitive school was only an elementary school. The non-punitive school was also a newer school (established for less than 10 years) than the punitive school.

Procedure

Children completed a hot and cool version of three EF tasks over two sessions (approximately 30 minutes in length and 1 week apart), with all three hot tasks in one session and all three cool tasks in another session. The order of the sessions was counterbalanced between participants. All sessions were administered in a separate school room by the same native female experimenter who was not informed of the specific study hypotheses. Data were coded by two coders who were blind to the hypotheses and to which school the children belonged. Additionally, school principals were interviewed at the beginning of the study and the parents of participants were interviewed one-on-one during the same week as child testing.

Discipline Practices. In the punitive school, disciplinary actions are routinely recorded in a log book in order to keep track of children's misbehavior and subsequent actions taken. Based on the log book we accessed, children in the punitive school witnessed on average 40 incidents (range: 15 to 65) of corporal punishment (slapping, pinching, hitting with a stick) per day. In the non-punitive school, no incidents of corporal punishment were recorded. We were not allowed to copy log books and were unable to obtain records regarding the participating children's personal record of punishment. Therefore, only average numbers of incidents of corporal punishment could be counted and reported here.

In both schools, parents of children who participated were asked to take part in one-on-one interviews about their attitude toward corporal punishment. In total, 26 parents (41 percent) participated in the survey: 14 from the punitive school and 12 from the non-punitive school. The remaining parents consented to their child's participation but were not available themselves for participation in the study. Interviews consisted of open-ended questions adapted from Oburu and Palmerus (2003) using six vignettes describing misbehaviors typical of children: (1) child refuses to sit in his chair; (2) child runs into a busy street, stumbling and falling; (3) child lies about breaking something; (4) child intentionally hits and causes injury to another child while playing; (5) child refuses to quiet down before bed; (6) child demands a bun at market while shopping with parent. Parents' answers to the question 'What would you do?' were scored from least intrusive to most intrusive: 1 = time outs (sending child to a corner/out of room); 2 = verbal reprimands (scolding, explaining why behavior is wrong); 3 = mild physical punishment (slapping, pinching, spank on the bottom); or 4 = severe forms of physical punishment (repeated beating, kicking, whipping). There was 93 percent inter-rater reliability. Parents' responses to the vignettes were scored (Cronbach's alpha = .78) and average parental discipline scores were calculated. Parents who were interviewed were also asked why they chose the respective schools for their children's education. Overall, 46 percent said reputation, 15 percent said location, 31 percent said reputation and location, and 8 percent gave other responses (e.g., choosing the school based upon family legacy).

Delay of Gratification. In this task, adapted from Mischel, Shoda, and Rodriguez (1989), the experimenter presented a small and large amount of treats placed in two bowls and asked children which bowl they preferred. All children indicated the larger amount. In the cool version, the small amount was one treat and the large amount was two treats. In the hot version, the small amount was two treats and the large amount was 10 treats. The experimenter then explained that she had to leave the room to do some work. Children were told that if they waited without eating the treats or leaving their seats while the experimenter was out of the room, they could have the larger amount. If they did not want to wait, they could ring a bell and the experimenter would return right away but they would only receive the smaller amount of treats. After a verbal rule check, the experimenter exited the room. Children's total waiting time (out of 8 min.), the number of touches to the treats or bowls, reaction time to first touch, and the total number of strategies used to avoid touching (e.g., turning away from the treats, talking and singing, etc.) were recorded, following Carlson and Beck (2009).

Gift Delay. The experimenter explained she had a 'surprise' present to wrap and children were asked to turn around in their seat (facing a hidden camera) and told not to peek while the experimenter wrapped a small gift noisily (60 seconds). In the cool version, they were told the gift was for another child, and in the hot version they were told that they themselves were going to receive a prize. Following Carlson (2005), coding included: (1) a peeking score (0 = turning fully around to peek, 1 = peeking over the shoulder, 2 = no attempt to peek); (2) the total number of times children peeked; and (3) latency to peek over the shoulder. Following Carlson and Moses (2001), we used a single standardized aggregate score of children's peeking behavior as the dependent variable in our analyses.

Dimensional Change Card Sort (DCCS). In this task adapted from Zelazo (2006), children were shown two boxes with target cards affixed to the front and given a series of cards to sort. In the cool version, cards were of familiar objects (red and blue rabbits and boats); in the hot version, cards depicted candies (red and blue jellybeans and lollipops). Children were then instructed how to play the game. For instance, in the cool version, the experimenter instructed children to place all the rabbits in the box with the red rabbit and to place all the boats in the box with the blue boat in the 'shape game'. After six consecutively correct trials, the experimenter announced that they would stop playing the shape game and now play the 'color game'. In this case, all the red things would go in the box with the red rabbit affixed and all the blue things would go in the box with the blue boat. She announced the rule before each trial, presented a card and labeled it (e.g., 'Here's a red one'), and then handed the card to the children. Total number of correct post-switch trials (out of six) was recorded.

Next, regardless of performance, all children were given the advanced DCCS, in which an additional level of complexity was added (Zelazo, 2006). The experimenter explained that if there is a star on a card, then children should sort according to color, but if there is *not* a star, then they should sort according to shape. There were 12 trials (six star, six non-star, interspersed). Scores were the total number of correct trials.

An analogous procedure was followed in the hot version, which was identical to the cool version except children were also told they would receive candies (shown on the cards) at the end of the game for good performance. All children received candies at the conclusion of the task.

Verbal Ability. The PPVT-III was used to assess children's receptive vocabulary and verbal ability. For this test, children are shown a page with four pictures and asked to point to the picture that matches a word the examiner says, continuing until the child errs on six or more items in a set of eight. Standard scores range from 40 to 160 for individuals 2.5 to 90+ years old, with a mean of 100 and a standard deviation of 15.

Results

Preliminary analyses revealed no significant sex differences and thus the data from boys and girls were combined. We then examined if children's cognitive performance differed according to school environment. Firstly, children's PPVT-III and parental discipline scores were analyzed to examine grade and school differences using a 2 (school) × 2 (grade) analysis of variance (ANOVA). Secondly, correlations between EF measures were reported. Thirdly, EF measures were analyzed to examine both between-subject factors of grade and school as well as within-subject factors of task (hot vs. cool) and EF measures [delay of gratification, gift delay, and dimensional change card sort (DCCS)] with PPVT-III as a covariate. To further examine the effects of school, grade, and task on children's performance, scores on each EF measure were then examined separately. A 2 (task: hot vs. cool) × 2 (grade: kindergarten vs. first) × 2 (school: punitive vs. non-punitive) repeated measures analysis of covariance (ANCOVA) with task as the within-subjects variable, PPVT-III scores as covariate, and grade and school as the between-subject variables was conducted on each of the EF measures. Finally, parent-reported discipline strategies were analyzed using a 2 (school) × 2 (grade) ANOVA.

Verbal Ability

The average age-standardized score on the PPVT-III was 101.92 (SD = 12.40, range = 70 to 128). Descriptive statistics for the raw scores are displayed in Table 1. An ANOVA with school and grade as between-subject factors found a significant grade effect, $F(1, 62) = 42.03$, $p < .001$, partial $\eta^2 = .44$, and a significant school effect, $F(1, 62) = 13.42$, $p < .01$, partial $\eta^2 = .19$. However, these main effects were qualified by a significant interaction between school and grade, $F(1, 59) = 11.26$, $p < .001$, partial $\eta^2 = .19$ (see Table 1). Whereas there was no significant difference at the kindergarten level, there was a significant difference in grade 1 ($p < .001$) with the children from the non-punitive school having higher scores. Given these significant effects, raw PPVT-III scores were used in subsequent analyses as a covariate.

Table 1. Mean Receptive Vocabulary (Standard Error) as a Function of Grade and School

School	Kindergarten	Grade 1
Punitive	62.28 (4.16)	78.0 (3.63)
Non-punitive	58.69 (7.63)	108.1 (5.81)

Table 2. Mean Parental Discipline Scores (Standard Error) as a Function of Grade and School

School	Kindergarten	Grade 1
Punitive	2.68 (.05)	2.61 (.05)
Non-punitive	2.58 (.06)	2.73 (.06)

Notes: 1 = least intrusive; 5 = most intrusive.

Parental Discipline

Next, parental responses regarding disciplinary beliefs were analyzed. As there were a number of missing cases, inspection of the data set revealed data were missing at random and thus, missing data values were imputed using maximum likelihood estimation. Overall, parents endorsed milder forms of parental discipline on the four-point scale ($M = 2.45$, $SD = .26$; range: 1 to 3). A 2 (grade: kindergarten vs. first) × 2 (school: punitive vs. non-punitive) ANOVA was conducted. There were no significant main effects found. There was a marginally significant interaction between grade and school, $F(1, 62) = 3.8$, $p = .061$, partial $\eta^2 = .06$ (see Table 2). Whereas in the punitive school there was no significant difference on the level of parental discipline between kindergarten and grade 1 children, there was a significant difference between kindergarten and grade 1 in the non-punitive school ($p < .01$). Parents of grade 1 children from the non-punitive school had higher parental discipline scores, indicating higher level of endorsement of intrusive discipline (e.g., corporal punishment). Given these significant effects, parental discipline scores were used in subsequent analyses as a covariate.

Performance on EF Measures

Table 3 shows the correlations between performance on the hot and cool versions of delay of gratification, gift delay, advanced DCCS, and verbal ability (with age partialled out). Performance on the hot and cool versions of each EF measure was significantly correlated. In addition, performance on the hot and cool versions of the advanced DCCS was significantly correlated with PPVT-III scores.

A 2 (task: hot vs. cool) × 3 (EF measure: gift delay, delay of gratification, DCCS) × 2 (grade: kindergarten vs. first) × 2 (school: punitive vs. non-punitive) repeated measures ANCOVA with task and EF measure as the within-subject variables, PPVT-III, and parent discipline scores as covariates, and grade and school as the between-subject variables was conducted. Due to differences in scoring scales, *z*-scores across all six tasks were used for number of touches in the delay of gratification (reversed), the aggregate gift delay score, and advanced DCCS scores. There was a marginally significant grade main effect, $F(1, 57) = 3.55$, $p < .07$, partial $\eta^2 = .06$. Older children had higher scores overall than younger children. There was a significant school × grade interaction effect, $F(1, 57) = 4.26$, $p < .05$, partial $\eta^2 = .08$. Figure 1 illustrates that although kindergartners had similar overall EF scores in both schools, grade 1 children in the non-punitive school had higher overall EF scores than their counterparts in the punitive school. Lastly, there was an EF measure × grade × school × task interaction,

Table 3. Correlations among Measures of Executive Function

Test	1	2	3	4	5	6
GD cool	—	—	—	—	—	—
GD hot	.32**	—	.—	—	—	—
DOG cool	−.08	−.04	—	—	—	—
DOG hot	−.05	.06	**.32***	—	—	—
DCCS cool	.10	−.04	−.04	−.13	—	—
DCCS hot	.11	−.03	.10	−.15	**.57****	—
PPVT-III	−.02	−.03	.07	−.21	.54**	.43**

Notes: Raw scores were used and age was partialed out.
GD = gift delay; DOG = delay of gratification; DCCS = dimensional change card sort; PPVT-III = Peabody picture vocabulary test-third edition.
* $p < .05$, ** $p < .001$, $df = 63$.

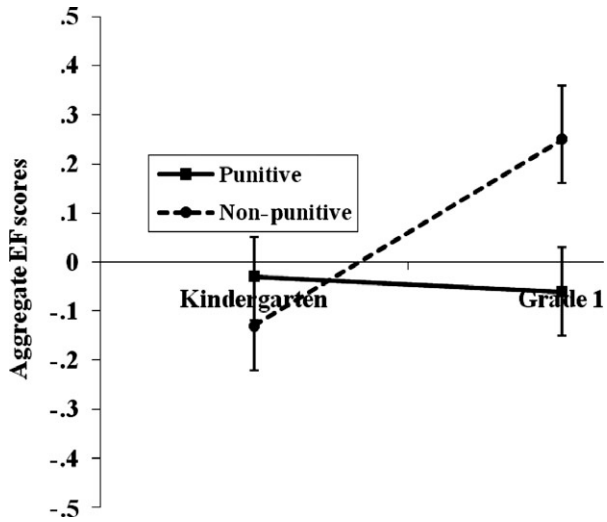

Figure 1. Children's aggregate executive functioning (EF) performance in the punitive and non-punitive schools. Bars represent standard error.

$F(2, 57) = 16.78$, $p < .01$, partial $\eta^2 = .23$. To further explore children's performance on the different measures of EF, each task was analyzed separately.

Delay of Gratification. The dependent variables of the total waiting time, number of touches (reversed), latency to first-touch, and the number of strategies used, were analyzed for both cool and hot versions of the task. A 2 (task: hot vs. cool) × 2 (grade: kindergarten vs. first) × 2 (school: punitive vs. non-punitive) repeated measures ANCOVA with task as the within-subjects variable, PPVT-III and parental discipline scores as covariates, and grade and school as the between-subject variables was conducted on each measure. No significant differences were found for the total waiting time or the latency to first touch the treats. However, for number of touches, indexing

Table 4. Mean (Standard Error) Number of Touches in the Delay of Gratification Task

School	Kindergarten	Grade 1
Punitive	.87 (.22)	1.15 (.22)
Non-punitive	1.49 (.27)	.75 (.26)

Note: Scores shown are based on the number of touches to the treats/plates before being reversed for analyses.

Table 5. Mean (Standard Error) Number of Strategies Used in the Delay of Gratification and Mean (Standard Error) Gift Delay Task Performance (*z*-Scores)

Task	School	Cool task	Hot task
Delay of gratification			
	Punitive	1.06 (.14)	1.11 (.12)
	Non-punitive	1.6 (.19)	.94 (.17)
Gift delay			
	Punitive	.36 (.18)	.11 (.18)
	Non-punitive	–.17 (.21)	–.05 (.21)

difficulty of delay (following Lengua et al., 2007), there was a task × PPVT-III interaction effect, $F(1, 57) = 3.95$, $p = .05$, partial $\eta^2 = .07$. A median split revealed that children with lower verbal scores had fewer touches on the cool versions ($M = .74$, $SD = 1.02$) compared with the hot version ($M = 1.20$, $SD = 1.35$) whereas children with higher PPVT-III scores were similar for the cool ($M = 1.12$, $SD = 1.37$) and hot ($M = 1.03$, $SD = 1.19$) tasks. There was also a significant interaction between school and grade, $F(1, 57) = 6.68$, $p < .05$, partial $\eta^2 = .12$. As seen in Table 4, kindergarten children in the non-punitive school ($M = 1.60$, $SD = 1.43$) touched the treats more often than grade 1 children ($M = .65$, $SD = 1.14$) whereas grade 1 children in the punitive school touched the treats more often ($M = 1.15$, $SD = .94$) than kindergartners ($M = .92$, $SD = 1.28$).

For the total number of instances of strategy use by children to resist temptation, there was a significant school × task interaction, $F(1, 49) = 5.34$, $p < .05$, partial $\eta^2 = .10$. To examine this interaction, a 2 (school) × 2 (grade) ANCOVA with PPVT-III and parental discipline scores as covariates on the cool task (1 vs. 2 treats) revealed a significant school effect, $F(1, 56) = 4.22$ $p < .05$, partial $\eta^2 = .08$: Children from the non-punitive school used more strategies to delay gratification than children from the punitive school, across grade levels (see Table 5). In comparison, the hot task (2 vs. 10 treats) revealed no significant differences in strategy use between the schools.

Gift Delay. Following Carlson and Moses (2001), we used a single standardized aggregate score of children's peeking behavior as the dependent variable in our analyses. A 2 (task: hot vs. cool) × 2 (grade: kindergarten vs. first) × 2 (school: punitive

vs. non-punitive) repeated measures ANOVA with task as the within-subjects variable, PPVT-III scores and parent discipline scores as covariates, and grade and school as the between subjects variables, was conducted. Although there were no significant main effects, there was a school × task interaction, $F(1, 57) = 5.38$, $p < .05$, partial $\eta^2 = .10$ (Table 5), suggesting that the advantage for children in the punitive school was stronger on the cool version (gift for other) than the hot version (gift for self). To examine this interaction, univariate analyses of the cool task revealed a significant school effect, $F(1, 59) = 10.16$, $p < .01$, partial $\eta^2 = .17$. Children in the punitive school demonstrated more control over peeking than their counterparts in the non-punitive school. Univariate analyses of the hot gift delay task found no significant school effects.

Dimensional Change Card Sort. First, children's initial postswitch scores were analyzed. A 2 (task: hot vs. cool) × 2 (grade: kindergarten vs. first) × 2 (school: punitive vs. non-punitive) repeated measures ANCOVA with task as the within-subjects variable, PPVT-III and parental discipline scores as covariates, and grade and school as the between-subject variables, was conducted. There was a school effect, $F(1, 53) = 4.35$, $p < .05$, partial $\eta^2 = .08$. Children in the punitive school had overall higher scores ($M = 5.59$, $SD = 1.38$) than children in the non-punitive school ($M = 4.61$, $SD = 1.89$). There was also a grade effect, $F(1, 53) = 11.02$, $p < .01$, partial $\eta^2 = .17$. Children in grade 1 had overall higher scores ($M = 5.74$, $SD = 1.48$) than children in kindergarten ($M = 4.53$, $SD = 1.92$). However, this was qualified by a grade × school interaction, $F(1, 53) = 6.35$, $< .01$, partial $\eta^2 = .12$. Table 6 shows that kindergarten children in the punitive school had higher scores than their non-punitive school counterparts, but this pattern was *reversed* for grade 1. There were no other significant main effects or interactions.

Next, the advanced DCCS scores were analyzed in the same manner. A 2 (task: hot vs. cool) × 2 (grade: kindergarten vs. first) × 2 (school: punitive vs. non-punitive) repeated measures ANCOVA with task as the within-subjects variable, PPVT-III and

Table 6. Mean scores (Standard Error) on the Dimensional Change Card Sort Task

	Standard	Advanced
Kindergarten		
Punitive		
Cool	5.47 (.30)	7.05 (.54)
Hot	5.42 (.35)	6.84 (.27)
Non-punitive		
Cool	3.36 (.59)	6.22 (.16)
Hot	4.0 (.30)	6.0 (.58)
Grade 1		
Punitive		
Cool	5.63 (.38)	6.8 (.30)
Hot	5.59 (.35)	6.4 (.43)
Non-punitive		
Cool	5.94 (.10)	10.07 (.57)
Hot	5.92 (.10)	8.36 (.46)

parent discipline scores as covariates, and grade and school as the between-subject variables, was conducted. There was a significant grade effect, $F(1, 57) = 20.03$, $p < .001$, partial $\eta^2 = .26$. Kindergarten children scored lower ($M = 6.53$, $SD = 1.51$) than the older children ($M = 8.01$, $SD = 2.16$). This was qualified by a significant interaction between school and grade, $F(1, 57) = 19.74$, $p < .001$, partial $\eta^2 = .26$. Whereas kindergarten children in the punitive school had slightly higher scores ($M = 6.82$, $SD = 1.67$) than those from the non-punitive school ($M = 6.11$, $SD = 1.87$), this pattern was *reversed* for older children. Older children from the punitive school had significantly lower scores ($M = 6.96$, $SD = 1.32$) than those from the non-punitive school ($M = 9.20$, $SD = 1.87$).

There was also a significant interaction between school and task, $F(1, 53) = 6.40$, $p < .05$, partial $\eta^2 = .11$. Children scored higher on the cool version ($M = 7.69$, $SD = 2.34$) compared with the hot version ($M = 7.00$, $SD = 1.65$). To examine this interaction, univariate analyses of the cool task revealed a significant school × grade interaction, $F(1, 59) = 14.75$, $p < .001$, partial $\eta^2 = .22$. Whereas kindergarten and grade 1 children in the punitive school had similar scores, in the non-punitive school grade 1 children had higher scores on the cool version of the advanced DCCS than the kindergarten children (see Table 6). Univariate analyses of the hot gift delay task found no significant differences.

Discussion

Children's EF Abilities in Punitive vs. Non-punitive Environments

Research on the development of EF has tended to focus on neurobiological changes that are strongly related to age, with relatively less attention paid to the social–environmental factors that are likely to affect the rate of change, stability over time, and ultimate level of EF that children attain. The aim of this research was to examine the executive control skills of children from two school environments that differed in their disciplinary philosophy and practices. Overall, there were significant differences between the two schools. Whereas younger children overall tended to be similar on EF tasks and PPVT-III scores, older children from the punitive school had poorer verbal scores than their counterparts from the non-punitive school. Further, after partialing out the effects of PPVT-III and parent-reported discipline at home, the EF scores of the older children in the punitive school were still poorer than those in the non-punitive school. These findings suggest that a harsh punitive environment may have long-term detrimental effects on both children's verbal intelligence and their EF ability.

Furthermore, although younger children in the punitive environment demonstrated some advantages in terms of immediate compliance (e.g., in the delay of gratification task) compared with their non-punitive environment counterparts, these advantages were reduced—and in some cases reversed—with age. Whereas overall EF performance in younger children was similar, there were significant differences in older children, with grade 1 children from the non-punitive school having higher scores than their punitive school counterparts. These differences were found even when parental discipline was controlled for. The age difference in the effect of a punitive environment on EF may be due to the amount of exposure to harsh discipline in their respective schools. Previous research has shown that there may be a dosage effect of punitive discipline on children's negative outcomes (Rohner, Bourque, & Elordi, 1996; Straus & Mouradian, 1998; Straus et al., 1997). For instance, Straus and Mouradian) found

that the more corporal punishment children experienced at home, the more they acted impulsively. Thus, our findings suggest that children with increased exposure to the harsh punitive school environment may be at risk for behavioral problems that are related to deficits in EF.

The Role of Socialization in EF Development

The findings of the present study are consistent with studies showing that authoritarian parental discipline has negative effects on social–cognitive performance (Hughes, Deater-Deckard, & Cutting, 1999; Pears & Moses, 2003; Ruffman, Perner, & Parkin, 1999), and with previous findings that children who experienced harsh discipline had lower cognitive ability (e.g., Smith & Brooks-Gunn, 1997; Straus & Paschall, 2009). For instance, previous research has found that intrusive control can lead to higher levels of fearful inhibition and positive control is associated with lower levels of fearful inhibition and better delay of gratification in preschool children (e.g., Chen et al., 1998; Putnam et al., 2002; Silverman & Ragusa, 1990).

Exposure to harsh disciplinary punishment may affect children's cognitive development through different processes. Straus and Paschall (2009) have suggested that the more adults engage in harsh punitive discipline like corporal punishment, the less likely they are to engage in more cognitive methods of behavioral control, such as explaining to the child why an object should not be touched. Congruent with this, in the current study, children in the non-punitive school displayed a greater number of intrinsically driven strategies for delaying gratification than children from the punitive school. This is also consistent with research findings that punitive methods of discipline can place external controls on children's behavior and have immediate effects of compliance; however, they may result in decreased likelihood that children will internalize rules and standards, which in turn may result in lower self-control with age (Gershoff, 2002; Grusec & Goodnow, 1994; Hirschi, 1969), when compared with more inductive techniques. Research has found that adults talking to children is associated with increases in children's neural connections in the brain and cognitive ability (Dawson & Fischer, 1994), and sensitively adjusting verbal input to meet children's current level of functioning predicts young children's EF (Bernier, Carlson, & Whipple, 2010). Thus, according to this theory, harsh corporal punishment diminishes the verbal interactions between children and adults that are needed to enhance cognitive development.

Furthermore, use of power-assertive techniques may direct children's attention to the adult–child power difference rather than the potential outcomes of children's behavior. Thus, such techniques do not promote children's problem-solving skills (Hess & McDevitt, 1984). According to Hoffman (2000), for example, power-assertive vs. inductive discipline relies on a power differential rather than reasoning, supports rule-following rather than internalized self-regulation, and promotes passivity on the part of children rather than active participation in conflict resolution. Gershoff (2002), in her meta-analysis of research on corporal punishment, reported that whereas such techniques have the benefit of immediate compliance, they are also associated with later detrimental child outcomes (e.g., aggression, lower levels of moral internalization, and mental health). Hence, the use of such discipline tactics may adversely affect children's EF over time due to lack of internalized self-regulation.

It is increasingly believed that early environmental experiences have a direct impact on brain development (e.g., Nelson, 2000). Harsh punitive discipline may affect

cognitive development via stress reactivity and associated neural function. Receiving physical punishment such as being slapped or hit is highly stressful for children (Turner & Finkelhor, 1996), and research has found that maltreatment can adversely affect brain development on both structural (e.g., De Bellis, 2001; Glaser, 2000) and functional levels (e.g., Curtis & Cicchetti, 2007; Perry, 2006). These findings are consistent with our study with regard to both PPVT-III and EF scores. For example, whereas there was no difference on PPVT-III scores between the schools in kindergarten, grade 1 children in the punitive school scored more poorly than those in the non-punitive school. This difference may be due to increased exposure to a punitive environment among the older children.

Cool vs. Hot EF

There were also differences in children's performance on the cool vs. hot task versions. Children with lower PPVT-III scores performed significantly worse on the hot version than the cool version of delay of gratification. Consistent with previous research, these results suggest that EF is compromised when young children are faced with highly salient 'hot' stimuli, such as candy, as compared with relatively cool stimuli, such as symbols (Carlson et al., 2005), and when making choices to delay gratification for another as opposed gratifying one's own desires (Prencipe & Zelazo, 2005). However, in children with higher PPVT-III scores, performance was equivalent on the two versions of the task. It is unlikely that results found in the present study are due to differential validity of measures in different populations. In previous studies with primarily North American samples, such measures have been used successfully with children of similar ages and the scores were comparable with those reported here (Carlson, 2005; Carlson & Moses, 2001; Kochanska, Murray, Jacques, Koenig, & Vandegeest, 1996; Mischel et al., 1989; Zelazo, 2006). Given that verbal ability is supportive of self-regulation, one possibility is that children with higher PPVT-III scores are better skilled at using their verbal abilities to control their actions and as a result found the EF tasks in the study relatively easy.

There was only partial support for the hypothesis that there would be an interaction between school environment and hot and cool tasks. When the EF measures were examined together, there was no interaction. This may be due to the fact that hot and cool EF measures rely upon similar cognitive abilities and tend to be correlated despite differing degrees of emotional–motivational involvement (Zelazo & Müller, 2002). In the current study, the hot and cool EF measures were found to be significantly correlated. However, when the EF measures were examined separately, there was an interaction between school and task for the gift delay and advanced DCCS tasks. In particular, it was expected that group differences would be more pronounced for hot EF tasks. This was not the case. For both tasks, although there were no differences in the hot versions, there was a significant difference between the school environments for the cool versions. In the gift delay task, children in the punitive school had higher scores than children in the non-punitive school. As discussed earlier, this is consistent with the assertion that harsh punitive environments may foster compliance (Gershoff, 2002). In the advanced DCCS, grade 1 children in the non-punitive school had higher scores than kindergarten children. However, there were no differences between grade levels in the punitive school on the cool version of the task. This is consistent with the hypothesis that although power-assertive discipline strategies like corporal punishment may foster compliance, they do not teach

children to internalize self-control. Thus, overall, EF performance was compromised by 'hot' stimuli regardless of school environment.

Limitations

Some caveats should be noted when interpreting the present findings. One is that like any natural experiment, children were not randomly assigned to different conditions. Any differences in the groups might also reflect parents' attitudes toward corporal punishment and their use of such methods at home. It is obviously unethical to randomly assign children to punitive or non-punitive environments to tease apart the effects of school and home environments (Gershoff, 2002; Straus et al., 1997). Thus, the present findings may reflect an aggregated effect of home and school environments. Based upon the parents, we were able to survey regarding parental discipline; however, most parents endorsed some form of 'mild' physical punishment, regardless of which school their children were enrolled in. Furthermore, it appeared that parents from the non-punitive school endorsed even *more* intrusive forms of discipline for grade 1 children than parents of children in the punitive school. It should be noted, however, that there was very little variability in parents' answers and we were unable to survey all parents whose children participated in the study. Because our findings of school environment appear to emerge in older children as a function of longer exposure (with parenting discipline controlled as a covariate), this further suggests that these results are probably not due to a selection bias. It is unlikely that any school selection effects would operate differently for younger and older children. Instead, differences in EF performance that were found in older children may be attributed to the fact that they had been exposed to their school's environment longer than the kindergarten children.

Another caveat is that the experimenter was not blind to which school she was testing in, as there was daily visible evidence of the discipline practices of each school. However, the experimenter was naïve to the hypotheses of the present study and the coders of video recordings were also naïve to the nature of the schools where the participants were from. In addition, although we were able to collect general data on the practices of each school, we were not able to measure the specific degree and amount of punitive and non-punitive discipline each participating child had received. However, given that discipline was a public event and created an atmosphere of expectations and consequences, even children who were not themselves regularly disciplined may have been influenced by such techniques. Indeed, social learning studies have shown that mere exposure to aggression and punishment has deleterious effects on children's behavior (e.g., Bandura, Ross, & Ross, 1961). Although we were not permitted to record directly incidents of corporal punishment in school or at home, our survey findings with parents suggest that differences in exposure to harsh discipline were more systematic between *schools* than between parents.

Nonetheless, the effects of a punitive environment need to be examined further in relation to individual differences in the child as well as the dynamic interactions between the adult and child. Negative and positive control can be both the antecedents and consequences of children's self-regulation behavior (Karreman et al., 2006; Scaramella & Leve, 2004). Research on the influence of parenting models on children's behavior suggests that children's behavior (negative or positive) can affect parental responses through mutual reinforcement, which can hinder children's self-regulation (Coplan et al., 2002; Scaramella & Leve). Although the current study found no sex differences, other studies have suggested that there are differential effects of harsh discipline for boys

and girls. For instance, Hughes et al. (1999) found that severity of discipline was positively correlated to boys' (but not girls') theory-of-mind understanding. Other research has suggested that cultural norms about corporal punishment may influence the impact such punishment has on children's aggressive behavior, and the magnitude of this relation (Deater-Deckard & Dodge, 1997; Lansford & Dodge, 2008). Thus, the relation between punitive discipline and social–cognitive performance may reflect a complex interactional model between adults, children, and social environment.

Overall, the present study found that with age, children exposed to a harsh punitive environment performed significantly worse on EF tasks than their counterparts in the non-punitive school, and as a result may be at risk for behavioral problems that are related to deficits in EF. In future research, it would be important to follow children longitudinally to see if their own pattern of performance changes from kindergarten to first grade and beyond, relative to peers in the other type of school. This research represents a new effort in EF research to examine the interplay of neurological and social factors that guide its development and suggests further research is needed along these lines.

References

Bandura, A., Ross, D., & Ross, S. A. (1961). Transmission of aggression through imitation of aggressive models. *Journal of Abnormal and Social Psychology*, *63*, 575–582.

Barkley, R. A. (1997). Behavioral inhibition, sustained attention and executive functions: Constructing a unified theory of ADHD. *Psychological Bulletin*, *121*, 65–94.

Baumrind, D. (1991). The influence of parenting style on adolescent competence and substance use. *Journal of Early Adolescence*, *11*, 56–95.

Baumrind, D. (1996). A blanket injunction against disciplinary use of spanking is not warranted by the data. *Pediatrics*, *98*, 828–831.

Baumrind, D. (1997). Necessary distinctions. *Psychological Inquiry*, *8*, 176–182.

Bechara, A., Damasio, H., Damasio, A. R., & Lee, G. P. (1999). Different contributions of the human amygdala and ventromedial prefrontal cortex to decision-making. *Journal of Neuroscience*, *19*, 5473–5481.

Bee, H. L., Barnard, K. E., Eyres, S. J., Gray, C. A., Hammond, M. A., Spietz, A. L., et al. (1982). Prediction of IQ and language skill from perinatal status, child performance, family characteristics, and mother-infant interaction. *Child Development*, *53*, 1134–1156.

Belsky, J., Rha, J. H., & Park, S. Y. (2000). Exploring reciprocal parent and child effects in US and Korean samples. *International Journal of Behavioral Development*, *24*, 338–347.

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development*, *81*, 326–339.

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: Promotion of self-regulation and the prevention of early school failure. *Development and Psychopathology*, *20*, 899–911.

Bull, R., & Scerif, G. (2001). Executive functioning as a predictor of children's mathematics ability: Shifting, inhibition, and working memory. *Developmental Neuropsychology*, *19*, 273–293.

Burt, C. H., Simons, R. L., & Simons, L. G. (2006). A longitudinal test of the effects of parenting and the stability of self control: Negative evidence for the general theory of crime. *Criminology*, *44*, 353–392.

Carlson, S. (2005). Developmentally sensitive measures of executive function in preschool children. *Developmental Neuropsychology*, *28*, 595–616.

Carlson, S. M., & Beck, D. M. (2009). Symbols as tools in the development of executive function. In A. Winsler, C. Fernyhough, & I. Montero (Eds.), *Private speech, executive functioning, and the development of verbal self-regulation* (pp. 163–175). New York: Cambridge University Press.

Carlson, S. M., Davis, A. C., & Leach, J. G. (2005). Less is more: Executive function and symbolic representation in preschool children. *Psychological Science*, *16*, 609–616.
Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development*, *72*, 1032–1053.
Chen, X., Hastings, P. D., Rubin, K. H., Chen, H., Cen, G., & Stewart, S. L. (1998). Child-rearing attitudes and behavioural inhibition in Chinese and Canadian toddlers: A cross-cultural study. *Developmental Psychology*, *34*, 677–686.
Clark, C., Prior, M., & Kinsella, G. (2002). The relationship between executive function abilities, adaptive behaviour, and academic achievement in children with externalising behavior problems. *Journal of Child Psychology and Psychiatry*, *43*, 785–796.
Cole, K., & Mitchell, P. (2000). Siblings in the development of executive control and a theory of mind. *British Journal of Developmental Psychology*, *18*, 279–295.
Coplan, R. J., Hastings, P. D., Lagace-Sequin, D. G., & Moulton, C. E. (2002). Authoritative and authoritarian mother's parenting goals, attributions, and emotions across different childrearing contexts. *Parenting: Science and Practice*, *2*, 1–26.
Curtis, W. J., & Cicchetti, D. (2007). Emotion and resilience: A multilevel investigation of hemispheric electroencephalogram asymmetry and emotion regulation in maltreated and nonmaltreated children. *Development and Psychopathology*, *19*, 811–840.
Dawson, G., & Fischer, K. W. (Eds.) (1994). *Human behavior and the developing brain*. New York: Guilford Press.
De Bellis, M. D. (2001). Developmental traumatology: The psychobiological development of maltreated children and implication for research, treatment and policy. *Development and Psychopathology*, *13*, 539–564.
Deater-Deckard, K., & Dodge, K. A. (1997). Externalizing behavior problems and discipline revisited: Nonlinear effects and variation by culture, context, and gender. *Psychological Inquiry*, *8*, 161–175.
Deci, E. L., Koestner, R., & Ryan, R. M. (1999). A meta-analytic review of experiments examining the effects of extrinsic rewards on intrinsic motivation. *Psychological Bulletin*, *125*, 627–668.
Dix, T., Ruble, D. N., & Zambarabo, R. J. (1989). Mothers' implicit theories of discipline: Child effects, parental effects, and the attribution process. *Child Development*, *60*, 1373–1391.
Eisenberg, N. (2000). Emotion, regulation, and moral development. *Annual Review of Psychology*, *51*, 665–697.
Eisenberg, N., Chang, L., Ma, Y., & Huang, X. (2009). Relations of parenting style to Chinese children's effortful control, ego resilience, and maladjustment. *Development and Psychopathology*, *21*, 455–477.
Garon, N., & Moore, C. (2004). Complex decision-making in early childhood. *Brain and Cognition*, *55*, 158–170.
Gershoff, E. T. (2002). Corporal punishment by parents and associated child behaviors and experiences: A meta-analytic and theoretical review. *Psychological Bulletin*, *128*, 539–579.
Glaser, D. (2000). Child abuse and neglect and the brain: A review. *Journal of Child Psychology and Psychiatry*, *41*, 97–116.
Grusec, J. E., & Goodnow, J. (1994). Impact of parental discipline methods on the child's internalization of values: A reconceptualization of current points of view. *Developmental Psychology*, *30*, 4–19.
Hastings, P., & Grusec, J. (1998). Parenting goals as organizers of response to parent-child disagreement. *Developmental Psychology*, *34*, 465–479.
Hay, C. (2001). Parenting, self-control, and delinquency: A test of self-control theory. *Criminology*, *39*, 707–736.
Hess, R. D., & McDevitt, T. M. (1984). Some cognitive consequences of maternal intervention techniques: A longitudinal study. *Child Development*, *55*, 2017–2030.
Heuer, F., & Reisberg, D. (1992). Emotion, arousal, and memory for detail. In S. A. Christianson (Ed.), *The handbook of emotion and memory: Research and theory* (pp. 151–180). Hillsdale, NJ: Lawrence Erlbaum.
Hirschi, T. (1969). *Causes of delinquency*. Berkeley, CA: University of California Press.
Hoffman, M. L. (2000). *Empathy and moral development: Implications for caring and justice*. New York: Cambridge University Press.

Hongwanishkul, D., Happaney, K. R., Lee, W. S. C., & Zelazo, P. D. (2005). Assessment of hot and cool executive function in young children: Age-related changes and individual differences. *Developmental Neuropsychology*, *28*, 617–644.

Hughes, C. (1998). Finding your marbles: Does preschoolers' strategic behavior predict later understanding of mind? *Developmental Psychology*, *34*, 1326–1339.

Hughes, C., Deater-Deckard, K., & Cutting, A. L. (1999). 'Speak roughly to your little boy?' Sex differences in the relations between parenting and preschoolers' understanding of mind. *Social Development*, *8*, 142–160.

Hughes, C., & Ensor, R. (2006). Behavioral problems in 2-year-olds: Links with individual differences in theory of mind, executive function and harsh parenting. *Journal of Child Psychology and Psychiatry*, *47*, 488–497.

Karreman, A., van Tuijl, C., van Aken, M. A. G., & Dekovic, M. (2006). Parenting and self-regulation in preschoolers: A meta-analysis. *Infant and Child Development*, *15*, 561–579.

Kerr, A., & Zelazo, P. D. (2004). Development of 'hot' executive function: The children's gambling task. *Brain and Cognition*, *55*, 148–157.

Kochanska, G. (2002). Committed compliance, moral self, and internalization: A meditational model. *Developmental Psychology*, *38*, 339–351.

Kochanska, G., & Aksan, N. (1995). Mother-child mutually positive affect, the quality of child compliance to requests and prohibitions, and maternal control as correlates of early internalization. *Child Development*, *66*, 236–254.

Kochanska, G., Coy, K. C., & Murray, K. T. (2001). The development of self-regulation in the first four years of life. *Child Development*, *72*, 1091–1111.

Kochanska, G., Murray, K. T., & Harlan, E. (2000). Effortful control in early childhood: Continuity and change, antecedents, and implications for social development. *Developmental Psychology*, *36*, 220–232.

Kochanska, G., Murray, K. T., Jacques, T. Y., Koenig, A. L., & Vandegeest, K. A. (1996). Inhibitory control in young children and its role in emerging internalization. *Child Development*, *67*, 490–507.

Lansford, J. E., & Dodge, K. A. (2008). Cultural norms for adult corporal punishment of children and societal rates of endorsement and use of violence. *Parenting Science & Practice*, *8*, 257–270.

Larzelere, R. E. (2000). Child outcomes of nonabusive and customary physical punishment by parents: An updated literature review. *Clinical Child and Family Psychology Review*, *3*, 199–221.

Lengua, L. J., Honorado, E., & Bush, N. (2007). Contextual risk and parenting as predictors of effortful control and social competence in preschool children. *Journal of Applied Developmental Psychology*, *28*, 49–55.

Locke, J. (1693/1909–14). *Some thoughts concerning education*. The Harvard Classics (Vol. 37). New York: P.F. Collier & Son.

Mischel, W., Shoda, Y., & Rodriguez, M. L. (1989). Delay of gratification in children. *Science*, *244*, 933–938.

Morrell, J., & Murray, L. (2003). Parenting and the development of conduct disorder and hyperactive symptoms in childhood: A prospective longitudinal study from 2 months to 8 years. *Journal of Child Psychology and Psychiatry*, *44*, 489–508.

Nelson, C. A. (Ed.), (2000). *The Minnesota symposia on child psychology, Vol 31: The effects of early adversity on neurobehavioral development*. Mahwah, NJ: Lawrence Erlbaum Associates.

Oburu, P. O., & Palmerus, K. (2003). Parenting stress and self-reported discipline strategies of Kenyan caregiving grandmothers. *International Journal of Behavioral Development*, *27*, 505–512.

Patterson, G. R., Reid, J. B., & Dishion, T. J. (1992). *Antisocial boys: A social interactional approach*. Eugene, OR: Castalia.

Pears, K. C., & Moses, L. J. (2003). Demographics, parenting, and theory of mind in preschool children. *Social Development*, *12*, 1–20.

Perry, B. D. (2006). Applying principles of neurodevelopment to clinical work with maltreated and traumatized children: The neurosequential model of therapeutics. In N. B. Webb (Ed.), *Working with traumatized youth in child welfare* (pp. 27–52). New York: Guilford Press.

Prencipe, A., & Zelazo, P. D. (2005). Development of affective decision-making for self and other: Evidence for the integration of first- and third-person perspectives. *Psychological Science*, *16*, 501–505.

Putnam, S. P., Spritz, B. L., & Stifter, C. A. (2002). Mother-child coregulation during delay of gratification at 30 months. *Infancy*, *3*, 209–225.

Rohner, R. P., Bourque, S. L., & Elordi, C. A. (1996). Children's perceptions of corporal punishment, caretaker acceptance, and psychological adjustment in a poor, biracial southern community. *Journal of Marriage and the Family*, *58*, 842–852.

Rousseau, J. J. (1762/1979). *Emile, or on education*. Trans. Allan Bloom. New York: Basic Books.

Rubia, K., Taylor, E., Smith, A., Oksanen, H., Overmeyer, S., & Newman, S. (2001). Neuropsychological analyses of impulsiveness in childhood hyperactivity. *British Journal of Psychiatry*, *179*, 138–143.

Rudy, D., & Grusec, J. E. (2006). Authoritarian parenting in individualist and collectivist groups: Associations with maternal emotion and cognition and children's self-esteem. *Journal of Family Psychology*, *20*, 68–78.

Ruffman, T., Perner, J., & Parkin, L. (1999). How parenting style affects false belief understanding. *Social Development*, *8*, 395–411.

Scaramella, L. V., & Leve, L. D. (2004). Clarifying parent-child reciprocities during early childhood: The early childhood coercion model. *Clinical Child and Family Psychology Review*, *7*, 89–107.

Silverman, I. W., & Ragusa, D. M. (1990). Child and maternal correlates of impulse control in 24-month-old children. *Genetic, Social and General Psychology Monographs*, *116*, 437–473.

Smith, J. R., & Brooks-Gunn, J. (1997). Correlates and consequences of harsh discipline for young children. *Archives of Pediatric Adolescent Medicine*, *151*, 777–786.

Straus, M. A. (1999). Is it time to ban corporal punishment of children? *Canadian Medical Association Journal*, *161*, 821–822.

Straus, M. A., & Mouradian, V. E. (1998). Impulsive corporal punishment by mothers and antisocial behavior and impulsiveness of children. *Behavioral Sciences and the Law*, *16*, 353–374.

Straus, M. A., & Paschall, M. J. (2009). Corporal punishment by mothers and development of children's cognitive ability: A longitudinal study of two nationally representative age cohorts. *Journal of Aggression, Maltreatment & Trauma*, *18*, 459–483.

Straus, M. A., Sugarman, D. B., & Giles-Sims, J. (1997). Spanking by parents and subsequent antisocial behavior of children. *Archives of Pediatrics and Adolescent Medicine*, *151*, 761–767.

Tafa, E. M. (2002). Corporal punishment: The brutal face of Botswana's authoritarian schools. *Educational Review*, *54*, 17–26.

Turner, H., & Finkelhor, D. (1996). Corporal punishment as a stressor among youth. *Journal of Marriage and the Family*, *58*, 155–166.

Turner, M. G., Piquero, A. R., & Pratt, T. C. (2005). The school context as a source of self-control. *Journal of Criminal Justice*, *33*, 327–339.

Zelazo, P. D. (2006). The dimensional change card sort (DCCS): A method of assessing executive function in children. *Nature Protocols*, *1*, 297–301.

Zelazo, P. D., Carlson, S. M., & Kesek, A. (2008). The development of executive function in childhood. In C. Nelson, & M. Luciana (Eds.), *Handbook of developmental cognitive neuroscience* (2nd ed., pp. 553–574). Cambridge, MA: MIT Press.

Zelazo, P. D., & Müller, U. (2002). Executive function in typical and atypical development. In U. Goswami (Ed.), *Handbook of childhood cognitive development* (pp. 445–469). Oxford: Blackwell.

Zhou, Q., Eisenberg, N., Wang, Y., & Reiser, M. (2004). Chinese children's effortful control and dispositional anger/frustration: Relations to parenting styles and children's social functioning. *Developmental Psychology*, *40*, 352–366.

