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The development of children's inhibition: Does parenting matter?

Isabelle Roskam *, Marie Stievenart, Jean-Christophe Meunier, Marie-Pascale Noël

Psychological Sciences Research Institute, Université Catholique de Louvain, 1348 Louvain-la-Neuve, Belgium

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ABSTRACT

Whereas a large body of research has investigated the maturation of inhibition in relation to the prefrontal cortex, far less research has been devoted to environmental factors that could contribute to inhibition improvement. The aim of the current study was to test whether and to what extent parenting matters for inhibition development from 2 to 8 years of age. Data were collected from 421 families, with 348 mother–child dyads and 342 father–child dyads participating. Children's inhibition capacities and parenting behaviors were assessed in a three-wave longitudinal data collection. The main analyses examined the impact of parenting on the development of children's inhibition capacities. They were conducted using a multilevel modeling (MLM) framework. The results lead to the conclusion that both mothers and fathers contribute through their child-rearing behavior to their children's executive functioning, even when controlling for age-related improvement (maturation) and important covariates such as gender, verbal IQ, and place of enrollment. More significant relations between children's inhibition development and parenting were displayed for mothers than for fathers. More precisely, parenting behaviors that involve higher monitoring, lower discipline, inconsistency and negative controlling, and a positive parenting style are associated with good development of inhibition capacities in children.

* Corresponding author. Fax: +32 10478589.
E-mail address: isabelle.roskam@uclouvain.be (I. Roskam).

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Introduction

Inhibition is a core component of executive functioning (EF), which refers to cognitive abilities involved in the control and coordination of processes in the service of goal-directed actions (Miller & Cohen, 2001). Inhibition refers to the ability to "control one's attention, behavior, thoughts, and/or emotions to override a strong internal predisposition or external lure, and instead do what's more appropriate or needed" (Diamond, 2013, p. 137). The development of inhibition throughout the preschool years is critical because it has been related to later social and academic development (Diamond, 2013). Moreover, in view of the rapid increase in inhibition from 2 to 5 years of age, it is particularly interesting to investigate its development during the preschool period (Brooks, Hanauer, Padowska, & Rosman, 2003; Garon, Bryson, & Smith, 2008).

A large body of research has investigated the maturation of EF in relation to the prefrontal cortex, one of the slowest developing areas of the brain (Garon et al., 2008). Myelination of this prefrontal cortex has been associated with age-related improvements in children's EF (Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012). Far less research has been devoted to environmental factors that could contribute to EF development and consequently explain individual differences in children's EF capacities (Matte-Gagné & Bernier, 2011). Because the family is the main developmental setting during the preschool period, parenting behaviors should be viewed as good candidates for influencing the developmental growth of EF. The aim of the current study, therefore, was to test whether and to what extent parenting matters for EF development from 2 to 8 years of age.

Parenting and the development of EF

Parenting has mainly been appraised in terms of two key dimensions: support and negative control (Aunola & Nurmi, 2005; Smetana & Daddis, 2002). Support encompasses the affective nature of the parent–child relationship and refers to a variety of related behaviors, including warmth, acceptance, involvement, autonomy, monitoring, and the establishment of guidelines. Negative control encompasses parents' efforts to control their children's behavior by means of coercion, inconsistent and harsh discipline, or punishment. Through supportive parenting, parents aim to enhance their children's cognitive development, for example, by explaining the rules the children need to follow. Supportive parenting is also thought to enhance children's social development by engaging them to be active participants in the interaction and by giving them responsibilities. Supportive parenting has been mainly related to positive outcomes for children (Bailey, Hill, Oesterle, & Hawkins, 2009; Boeldt et al., 2012; Hipwell et al., 2008; Rohner, 1986), whereas negative control has been repeatedly associated with negative outcomes (Bailey et al., 2009; Barnett, Shanahan, Deng, Haskett, & Cox, 2010; Lansford et al., 2011).

The models and research efforts that have been put forward and described with regard to parents' effect on EF growth have tended to consider the effect of supportive rather than negative controlling parenting. First, parenting has been thought to influence both emotional regulation and cognitive abilities as two key elements of EF definition (Diamond, 2013; Miller & Cohen, 2001). For its effect on the emotional side, Hughes and Ensor (2009) proposed the *global imitation model*, which emphasizes the positive effect of a calm and positive parental response to children's negative emotion on "effortful control," a key component in children's emotional regulation closely related to EF (Valiente, Lemery-Chalfant, & Reiser, 2007). The longitudinal association between negative emotional reactivity during infancy and EF at 4 years of age has recently been documented (Ursache, Blair, Stifter, & Voegtline, 2013). In this research, high emotional reactivity combined with high emotional regulation measured at 15 months of age was associated with better EF at 4 years of age. Moreover, children characterized by both emotional reactivity and regulation had primary caregivers who exhibited a higher level of positive parenting than those of other types of children. Thus, parental support is also viewed as having a buffer effect against affective overarousal in children. In the absence of overarousal, it is contended that children are better able to focus their attention and regulate their behavior (Dierckx et al., 2011; Feldman, 2003). For its effect on cognitive abilities, Hughes and Ensor (2009) suggested the *scaffolding model*, which refers to parents' ability to provide information and assistance in a manner that supports their children's attention, memory, and language abilities (Landry, Miller-Loncar,

Smith, & Swank, 2002). In their empirical study, Hughes and Ensor (2009, p. 49) provided support for this *scaffolding model:* the extent to which mothers engaged in open-ended questions, praise, encouragement, or elaboration during a structured activity predicted individual differences in children's EF performances. Similar to scaffolding, parental autonomy support consists of taking children's perspective, respecting their rhythms, and ensuring that they play an active role in successful completion of tasks (Matte-Gagné & Bernier, 2011, p. 613). This tendency of caregivers to treat young children as individuals with minds was found to be a strong predictor of children's EF (Bernier, Carlson, Deschênes, & Matte-Gagné, 2012; Bernier, Carlson, & Whipple, 2010). In addition, positive maternal parenting as perceived by 7- to 16-year-old children was recently reported to be associated with children's EF, in particular, planning and problem solving performance (Samuelson, Krueger, & Wilson, 2012).

Second, the influence of parenting on EF growth has been thought to operate through elicitation of positive emotions in children and higher security in parent–child relationships. Parental support has been hypothesized as eliciting positive emotions in children who are in turn more motivated to obey their parents' rules by inhibiting undesirable behavior and paying attention and to learn from interactions (Eisenberg et al., 2005). This was found to be the case in a recent micro trial study in which the self-efficacy beliefs of parents of 4- and 5-year-old children were affirmed (Mouton & Roskam, submitted for publication). Compared with the control participants, the mothers who had received such affirmation behaved more positively toward their children, who in turn were more enthusiastic, showed a higher rate of positive affect in the interaction, and were less irritated in frustrating tasks. Positive emotions elicited by supportive parenting have also been found to promote cognitive abilities such as problem solving (Leerkes, Blankson, O'Brien, Calkins, & Marcovitch, 2011; Otsui & Tanaka-Matsumi, 2007; Park & Woo, 1997; Russ & Kaugars, 2001) and stress coping strategies (Foster, Reese-Weber, & Kahn, 2007; Gentzler, Contreras-Grau, Kerns, & Weimer, 2005; Zimmer-Gembeck, Lees, & Skinner, 2011), both of which are thought to be involved in attentional and behavioral regulation skills (Eisenberg et al., 2005; Leerkes, Blankson, O'Brien, Calkins, & Marcovitch, 2011; Otsui & Tanaka-Matsumi, 2007; Park & Woo, 1997; Russ & Kaugars, 2001). Finally, it has been suggested that support affects the quality of parent–child relationships, in particular the security of attachment (Roskam, Stievenart, Van de Moortele, & Meunier, 2011), which in turn is related to better emotional and behavioral regulation (Lay, Waters, Posada, & Ridgeway, 1995; Panfile & Laible, 2012; Smith, Calkins, & Keane, 2006).

In contrast to positive parenting, the effect of controlling parenting on EF development has been less well documented. However, hostile parenting could be considered as a risk factor for EF growth (Eisenberg et al., 2005). In existing empirical research, the results are somewhat inconsistent. The impact of inconsistent discipline on children's EF has been reported to be low (Hughes & Ensor, 2009). But negative parental reactions to children's negative emotions have been related to lower effortful control (Valiente et al., 2007). In addition, a meta-analysis of the association between both positive and negative controlling parenting and self-regulation has been conducted (Karreman, van Tuijl, van Aken, & Dekovic, 2006). Self-regulation was conceptualized according to three main dimensions in the studies reviewed: compliance, inhibition, and emotion regulation. Positive control included limit setting, directiveness with low to moderate power assertion, guidance, and instructional behavior. Negative control included power-assertive control, negativity, coercive behaviors, hostility, utterance of criticism, intrusiveness, overcontrol, and overinvolvement. Both positive and negative controlling behaviors were linked to preschoolers' self-regulation, but only when this was conceptualized along with compliance rather than with inhibition or emotion regulation. As was the case with supportive parenting, the influence of controlling parenting could also be conjectured to operate through emotional processes. For example, disciplining children may instill fear, which in turn may make it difficult for children to inhibit impulsive behavioral responses. In the same way, ignoring children could also be linked to emotional disturbances and relational anxiety, which in turn could provoke overreactive behaviors aimed at retaining parents' attention. To the best of our knowledge, such an influence of parenting on EF development has never been tested.

The existing literature documenting the relation between parenting and children's EF has a number of shortcomings. First, it mainly focuses on mothers' parenting regardless of the specific contribution of fathers to their children's EF development (Brown, Mangelsdorf, & Neff, 2012). Although Bernier and colleagues (2012) considered both mothers and fathers, they computed a single factor of parenting quality including data from both parents, making it impossible to study any specific contribution.

Studies considering the specific role of fathers reported different relations for the two parents. For example, low paternal sensitivity and intrusive behavior were related to children's subsequent inattentiveness and impulsivity, respectively, whereas low maternal positive regard was associated with later inattentiveness (Keown, 2012). In a recent study, infants' compliance at 20 months of age was predicted by their temperament at 3, 5, and 7 months of age and by their attachment to the mother and father at 12 to 14 months of age. Mothers and fathers were both found to contribute to outcomes in terms of later social competence (Lickenbrock et al., 2013). Second, empirical research on this topic is mostly cross-sectional or based on prospective longitudinal studies. However, children's EF and parents' behavior are dynamic variables, the development of which need to be studied and related together (Hammond et al., 2012; Roskam & Meunier, 2012). Third, the panel of parenting behaviors that has been studied in relation to EF development is somewhat limited, focusing in particular on child-rearing behaviors similar to scaffolding (Bernier et al., 2012).

The current study

The current study examined inhibition development among preschoolers. Because of the maturation process, a significant improvement in inhibition is expected between 2 and 8 years of age. The main purpose of the study was to find out whether and to what extent parenting relates to children's EF growth rate. The current study avoided some of the shortcomings in previous research. A large panel of child-rearing behaviors was considered, encompassing both supportive parenting (i.e., positive parenting, monitoring, autonomy demands, and rule setting) and controlling parenting (i.e., discipline and inconsistent discipline, material rewarding, ignoring, and harsh punishment). These nine first-order and two second-order parenting behaviors were considered in both mothers and fathers in a three-wave longitudinal design where both EF and parenting were measured in each wave. In addition, the relation with parenting was assessed after controlling for some key variables known to be related to EF development. Thus, both gender and verbal IQ are treated as covariates; gender-related differences in EF in favor of girls have been reported among young children (Raaijmakers et al., 2008), and theorizing and empirical evidence suggest that children with better verbal IQ are better equipped to develop higher EF (e.g., Hammond et al., 2012; Landry et al., 2002; Matte-Gagné & Bernier, 2011). Verbal abilities provide tools such as self-directed speech for organizing input from the environment to engage in more complex thinking and to achieve goals (Barkley, 1997; Fernyhough, 2009; Zelazo, Müller, Frye, & Marcovitch, 2003). Their role in the developmental process of children's EF has been empirically demonstrated (Landry et al., 2002; Matte-Gagné & Bernier, 2011).

Method

Sample and procedure

This study was part of the longitudinal H2M (Hard-to-Manage) Children research program, which is being conducted by the Psychological Sciences Research Institute at the Université Catholique de Louvain (UCL) in Belgium. Data were collected from 421 families, with 348 mother–child dyads and 342 father–child dyads participating. Approximately 57% of the children were boys. Fully 70% of the dyads were recruited thanks to the fruitful collaboration of five randomly selected nursery schools in the French-speaking part of Belgium. A letter was given to the parents of children aged 2.5 to 5 years to inform them about the study and ask whether they were willing to participate with their children in the three-wave longitudinal research program. The remaining 30% of the sample was enrolled thanks to collaboration with the Department of Pediatrics of the Cliniques Universitaires Saint-Luc, a university hospital in Brussels. Parents who met the inclusion criteria of having children aged 2.5 to 5 years who did not display substantial language delays, developmental disorders, intellectual disability, chronic disease, or neurological impairment were informed by the pediatricians about the longitudinal research project. The vast majority of them had contacted the pediatric department because of behavioral concerns about their children. All of the parents were assured that the data would remain confidential.

The living situations of nearly all (87%) of the children included both biological parents. However, 13% of the parents were separated or divorced at the outset of the study. In families where parents were separated or divorced, both the mother and father were involved in child rearing. Of the families who took part in the study, 20% had only one child, 46% had two children, and 34% had three or more children at the start of the study. The educational level of the parents was taken as the number of years of education they had completed. Approximately 27% of mothers had completed 12 or fewer years (corresponding to the end of secondary school in Belgium), 56% had completed 3 more years (corresponding to undergraduate studies), and 17% had completed a 4-year degree or more. The comparable figures for fathers were 37%, 42%, and 21%.

The data presented come from three waves of assessment: the start of the research program (T1), the 12-month follow-up (T2), and the 24-month follow-up (T3). The mean age of the children was 55.28 months (range = 31–91, *SD* = 11.14) at the time of recruitment, 65.38 months (range = 36–96, *SD* = 11.86) at T2, and 75.09 months (range = 40–100, *SD* = 12.30) at T3.

At T1, T2, and T3, the mothers and fathers were asked to independently complete a questionnaire that assessed their parenting behaviors toward the target children. At all three time points, the children completed a series of inhibition tasks at school or in the pediatric department according to their place of enrollment. At T1, each child also completed a measure of his or her verbal IQ. As is almost inevitable in longitudinal designs when the sample is followed up annually across three waves, there was a significant dropout rate (e.g., the parent did not return the questionnaire, the child was ill at the time of the annual school visit). For mothers, the dropout rate at T2 was 29%, with an additional attrition rate of 4% at T3. For fathers, the dropout rate was 29% at T2, with an additional attrition rate of 10% at T3. For children, the dropout rate was 10% at T2, with an additional attrition rate of 2% at T3.

Measures

Inhibition was assessed with six tasks. In the first five tasks, there was a control condition in which no inhibition was involved and a test condition that required the inhibition of a dominant response. In the three blobs task (Balamore & Wozniack, 1984), the child needed to tap with a hammer on three colored spots in succession: first the one on the left, then the one in the middle, and then the one on the right (10 times in a row). In the test condition, the child was asked to tap the spots in an unusual direction: left, right, and then middle. In Luria's hand game (Diamond & Taylor, 1996), the child needed to mimic the examiner's action in the test condition (tap once or twice on the table) but do the opposite of the examiner's action in the test condition. In the card sorting test (Brooks et al., 2003), the child needed to place rabbit cards on the rabbit model card and truck cards on the truck model card in the control condition and do the opposite in the test condition. In both conditions, the first eight cards varied only in shape (rabbit or truck), but the last eight also varied in color (blue or yellow). In the cat, dog, and fish test inspired by the day–night task (Gerstadt, Hong, & Diamond, 1994), the child saw a series of drawings of cats, dogs, and fish and needed to name each drawing as fast as he or she could in the control condition. In the test condition, the child was required to say "cat" when he or she saw a dog, "dog" when he or she saw a cat, and "fish" when he or she saw a fish. In the monsters Stroop test (developed by Censabella & Noël, 2005), rows of drawings of monsters in different colors were presented to the child, who needed to name the color of each monster (control condition). In the test condition, each monster was placed on a different colored background square and the child needed to name the color of the monster, avoiding distraction from the color of the background. Finally, we used the NEPSY statue test (Kemp, Kirk, & Korkman, 2001), in which the child was asked to maintain a body position with eyes closed and without talking during a 75-s period and to inhibit the impulse to respond to sound distractors. An inhibition score was computed through factorial analysis. The psychometric properties of the measure were considered in a previous study (Meunier, Roskam, Stievenart, Van de Moortele, & Noël, submitted for publication). Correlations among the six tasks in the overall sample ranged from .30 to .58. Cronbach's alpha yielded .76 for the overall sample and .74, .69, and .77 for the first, second, and third measurement occasions. Factorial invariance analyses showed that the inhibition score yielded criteria for strong partial measurement invariance and, therefore, was comparable across ages. Factor loadings ranged from .43 to .72 (M = .628) at 3 years of age, from .38

to .77 (M = .565) at 4 years of age, from .34 to .80 (M = .596) at 5 years of age, from .30 to .65 (M = .540) at 6 years of age, and from .40 to .83 (M = .605) at 7 and 8 years of age. From these six factor models, only three factor loadings were below .40—one for each of the 4-, 5-, and 6-year-old models—suggesting that the inhibition factor was adequately represented by the tasks. In the current study, the inhibition score has been computed so that a higher score indicates higher inhibition capacities.

Parenting was assessed at T1, T2, and T3 by the mothers and fathers with the preschool form of the Evaluation des Pratiques Educatives Parentales (EPEP–PPSF) (Meunier & Roskam, 2009). The EPEP–PPSF is a 40-item instrument yielding nine first-order factors: positive parenting (“When my child seems to have a problem, I discuss with him/her what is wrong”), monitoring (“I keep track of the friends my child is seeing”), rules (“I teach my child to adapt to the habits in our family”), discipline (“When my child becomes too agitated or bothersome, I punish him/her”), inconsistent discipline (“When I have punished my child, I sometimes let him/her off the punishment early”), harsh punishment (“When my child gets on my nerves or is really exasperating, I occasionally resort to physical punishment [spanking, slapping]”), ignoring (“When my child does something that is not allowed, I only talk to him/her again when he/she behaves better”), material rewarding (“When my child displays exemplary behavior, I give him/her a little surprise or something else as a reward”), and autonomy (“I teach my child to solve his/her own problems”). A 5-point Likert-type scale is provided for each item, ranging from *never* to *always.* This instrument has been validated on 565 French-speaking mothers and fathers of children developing normally and shows good psychometric properties. For the nine-factor solution extracted in the validation study, Cronbach’s alphas ranged from .59 to .90 (mean α = .78) for mothers and from .66 to .90 (mean α = .78) for fathers; the total percentages of variance explained were 60.96% for mothers and 62.52% for fathers (Meunier & Roskam, 2009). Confirmatory factor analyses from the validation study showed that two second-order factors covering the supportive and negative controlling dimensions of parenting emerged from the initial factor solution. The supportive factor was composed of positive parenting, autonomy, and rules. The negative controlling factor was composed of discipline, harsh punishment, and ignoring. The fit measures in the validation study demonstrated an acceptable fit to the data, with comparative fit index (*CFI*) = 0.94, root mean square residual (*RMR*) = 0.03, and root mean square error of approximation (*RMSEA*) = 0.05 (Hu & Bentler, 1999; Meunier & Roskam, 2009).

The verbal IQ of the children was evaluated at T1 with the Information subtest of the Wechsler Preschool and Primary Scales of Intelligence (WPPSI-III; Wechsler, 2004).

Analysis strategy

Prior to examining the developmental course of inhibition, several preliminary analyses were conducted. First, descriptive statistics were calculated on all of the variables under investigation. Second, Pearson correlation coefficients were calculated to examine the stability of children’s inhibition and parenting over time. Other correlations examined the relations between the nine first-order scales and the two second-order scales measuring parenting among the mothers and fathers as well as the relations between the mothers’ and fathers’ child-rearing behaviors. These have been calculated in order to avoid potential multicollinearity among the predictors.

The main analyses were those intended to examine the association between parenting and the development of children’s inhibition when controlling for children’s gender, verbal IQ, and place of enrollment. They were conducted using a multilevel modeling (MLM) framework with HLM 7 software (Raudenbush, Bryk, & Congdon, 2012). MLM capitalizes on the multilevel structure of the data, providing information about the variability of individuals over time (Level 1, repeated measures) as well as between individuals (Level 2). Because attrition is common in longitudinal data, MLM estimates are based on all the available data but without imputing data (McCartney, Bub, & Burchinal, 2006). HLM uses the maximum likelihood estimation, which does not require the assumption of missingness completely at random (Little, 1988). This method was chosen because it allowed the inclusion of parents who did not participate at each measurement point in the study sample. In our sample, missing data do not pose a great threat. Hence, the comparisons between the participants who dropped out in T2 or T3 and those who completed the three waves of assessment displayed no signif-

icant differences either for the sociodemographic variables or for the variables under consideration, that is, inhibition and parenting.

We tested a model to predict the developmental trajectories of children's inhibition, that is, the *unconditional growth model* in which time is the only predictor.[1] The time component used was the child's age, estimated in months, at each of the three assessment points. This enabled us to compute an accelerated design from 31 to 100 months of age (2.51–8.33 years). The aim of an accelerated design is to estimate mean change and its predictors over a broad range of ages by using data collected over a relatively short period of time (Miyazaki & Raudenbush, 2000).

The *conditional models* tested the effect of parenting behaviors on inhibition development. First, we computed a model for the mothers encompassing the nine first-order parenting factors: positive parenting, monitoring, rules, discipline, inconsistent discipline, harsh punishment, ignoring, material rewarding, and autonomy. Second, we computed another separate conditional model for the mothers considering the two second-order factors: support and negative control. These two first conditional models were intended to test whether and to what extent maternal child-rearing behaviors were related to the inhibition developmental course when controlling for children's gender, verbal IQ, and place of enrollment. We replicated the same two conditional models with the fathers in order to show how paternal child-rearing behaviors contributed to children's inhibition development. Finally, two common conditional models were computed considering both the mothers' and fathers' child-rearing behaviors: the first with the nine first-order parenting factors and the second with the two second-order parenting factors. These last two conditional models were intended to test the respective contributions of the two parents to their child's growth in inhibition.

MLM allows both time-varying and time-invariant predictors to be included in the models (Raudenbush, Brennan, & Barnett, 1995). As a result, we were able to predict the change in inhibition from changes in parenting behaviors as well as to control for time-invariant covariates (child's gender, verbal IQ, and place of enrollment). Time-varying predictors were added to the Level 1 equation, and time-invariant covariates were added to the Level 2 equation (see Raudenbush et al., 1995). Time-varying predictors are composed of two sources of variations: within- and between-person variations. Within-person variations are seen as acute factors giving reasons why parenting is better or worse on some measurement occasions than on others. On the positive side, these variations could conceptually represent parental awareness of behavioral fluctuations in children, for example, the parent's need to make more autonomy demands when the child's inhibition improves. On the other hand, they could result from inconsistency in parenting behaviors over time and, therefore, could be expected to have a negative influence on the developmental trajectory. Between-person variations represent chronic factors that can result in the parenting of a given child being more or less supportive on average, for example. These variations reflect typical inter-individual differences among the mothers and fathers. Some of them are on average more likely to endorse harsh parenting or to use rewarding material than are others. The effects of within- and between-person variations have been differentiated in the models in order to test the effect of the variations in parenting over time at Level 1 and the pure between effect at Level 2 (Hoffman & Stawski, 2009). At Level 1 (within-person variations), parenting behaviors in the three waves of assessment were within-person centered and constrained to have fixed effects. Their average level over the two or three available assessment waves was calculated and added as predictors of the slope coefficient at Level 2 (between-person variations) (Hoffman & Stawski, 2009). Note that within-person centering at Level 1 is an important technique for addressing bias in time-varying covariates due to unobserved heterogeneity or unmeasured factors that vary across individuals and

[1] The intercept was not a matter of particular interest for the current study. Concretely, the intercept represents the value of *y* (children's inhibition) when *x* (children's age in months) equals zero. In an accelerated design with several cohorts, the meaning of the results for the intercept is somewhat confusing and less interesting than in a true longitudinal design, mostly because the first measurement point of the three cohorts does not correspond to a common observed intercept (Duncan, Duncan, & Hops, 1996). Furthermore, it can conceptually be considered that at age zero, children's inhibition is at its point of inception. This point should theoretically be more similar than different among humans. Therefore, low individual variability would be observed around the intercept. In the *unconditional growth model*, the results from the random section indicated nonsignificant individual variability around the slope, with a random effect variance of .005 ($p > .10$). For these reasons, the intercept was no longer under consideration in the analyses.

have a consistent effect over time on the construct of interest (Coley, Votruba-Drzal, & Schindler, 2008).

Results

Preliminary analyses

Descriptive statistics for children's inhibition and verbal IQ as well as for parenting behaviors are presented in Table 1. The correlation coefficients examining the stability over time of inhibition were .64, .61, and .60 for T1–T2, T1–T3, and T2–T3, respectively. The correlation coefficients examining the stability over time of parenting behaviors are presented in Table 2. They ranged from .13 to .69 for the fathers and from .37 to .67 for the mothers, suggesting that parenting was moderately stable over time. In sum, parents showed some consistent patterns of child-rearing behavior, but their behaviors also varied across the three measurement occasions.

The correlation coefficients examining the relations between the nine first-order factors (mean scores at T1, T2, and T3) of parenting behaviors are presented in Table 3. The correlations between the second-order factors were $r = -.12$, $p < .05$ for mothers and $r = -.06$, $p > .05$ for fathers. These low to moderate correlations between the parenting factors suggest that they can be introduced together as predictors in the conditional models because of the absence of multicollinearity. The tolerance indexes from the collinearity tests were greater than .43/.49, .60/.57, and .37/.39 for the mothers/fathers at T1, T2, and T3, respectively.

The correlation coefficients examining the relations between the mothers' and fathers' nine first-order parenting behaviors (mean scores at T1, T2, and T3) are presented in Table 4. The correlation between the mothers' and fathers' second-order factor of support was $r = .33$, $p < .001$. For control, it was $r = .57$, $p > .001$. These correlations between the parents suggest that their parenting behaviors can be considered together as predictors in the conditional models because of the absence of multicollinearity. The tolerance indexes were greater than .14, .31, and .19 at T1, T2, and T3, respectively.

Table 1
Descriptive statistics for children's inhibition, verbal IQ, and parenting behaviors.

	T1	T2	T3	Mean
Children				
Inhibition	1.05 (0.59)	1.57 (0.65)	1.87 (0.64)	1.41 (0.58)
Verbal IQ	9.57 (2.36)			
Mothers				
Positive parenting	4.15 (0.49)	4.33 (0.54)	4.30 (0.47)	4.23 (0.45)
Monitoring	3.47 (0.89)	4.20 (0.76)	4.31 (0.60)	3.82 (0.74)
Rules	4.50 (0.45)	4.59 (0.39)	4.55 (0.44)	4.53 (0.41)
Discipline	3.43 (0.70)	3.36 (0.74)	3.29 (0.77)	3.39 (0.43)
Inconsistent discipline	2.71 (0.81)	2.30 (0.63)	2.89 (0.61)	2.53 (0.69)
Harsh punishment	2.24 (0.81)	2.01 (0.70)	1.93 (0.70)	2.12 (0.74)
Ignoring	2.01 (0.84)	1.90 (0.80)	2.09 (0.82)	2.00 (0.76)
Material rewarding	2.50 (0.69)	2.59 (0.76)	2.83 (0.76)	2.57 (0.68)
Autonomy	3.56 (0.71)	3.78 (0.55)	3.80 (0.59)	3.68 (0.59)
Fathers				
Positive parenting	3.88 (0.49)	3.96 (0.57)	3.92 (0.66)	3.91 (0.47)
Monitoring	3.05 (0.79)	3.85 (0.83)	3.97 (0.79)	3.39 (0.69)
Rules	4.38 (0.44)	4.40 (0.31)	4.37 (0.54)	4.38 (0.40)
Discipline	3.34 (0.56)	3.30 (0.66)	2.92 (0.81)	3.27 (0.53)
Inconsistent discipline	2.71 (0.71)	2.34 (0.71)	2.28 (0.69)	2.57 (0.60)
Harsh punishment	2.21 (0.73)	2.08 (0.81)	1.82 (0.83)	2.16 (0.73)
Ignoring	2.01 (0.75)	1.99 (0.79)	2.24 (0.81)	2.05 (0.67)
Material rewarding	2.63 (0.61)	2.72 (0.69)	2.99 (0.77)	2.71 (0.55)
Autonomy	3.64 (0.58)	3.66 (0.58)	3.61 (0.69)	3.64 (0.49)

Note. Values are means with standard deviations in parentheses.

Table 2
Pearson correlation coefficients examining the stability of parenting behaviors.

	T1		T2	
	M	F	M	F
Positive parenting				
T2	.67***	.56***		
T3	.66***	.51***	.63***	.69***
Monitoring				
T2	.58***	.53***		
T3	.37***	.34***	.49***	.50***
Rules				
T2	.52***	.58***		
T3	.46***	.42***	.55***	.51***
Discipline				
T2	.58***	.51***		
T3	.51***	.20**	.44***	.13
Inconsistent discipline				
T2	.54***	.52***		
T3	.44***	.22**	.49***	.14
Harsh punishment				
T2	.61***	.57***		
T3	.64***	.36***	.59***	.41***
Ignoring				
T2	.59***	.52***		
T3	.48***	.38***	.52***	.48***
Material rewarding				
T2	.63***	.46***		
T3	.52***	.18*	.58***	.31***
Autonomy				
T2	.42***	.35***		
T3	.38***	.39***	.43***	.47***

Note. M, male; F, female.
* $p < .05$.
** $p < 0.01$.
*** $p < .001$.

Table 3
Pearson correlation coefficients examining the relations between the nine first-order scales of parenting behaviors.

	1	2	3	4	5	6	7	8	9
1. Positive parenting	–	.21***	.46***	.04	−.23***	−.29***	−.09	−.03	.42***
2. Monitoring	.35***	–	.28***	.19***	−.12*	−.14**	.10*	.09	.12*
3. Rules	.39***	.43***	–	.28***	−.32***	−.12*	−.01	−.14**	.34***
4. Discipline	.10*	.09	.27***	–	−.22***	.35***	.18***	.10*	−.01
5. Inconsistent discipline	−.20***	−.16***	−.26***	−.07	–	.08	.03	.15**	−.18***
6. Harsh punishment	−.24***	−.14**	−.13*	.26***	.22***	–	.30***	.21***	−.24***
7. Ignoring	−.14**	.13**	−.03	.10*	.17***	.20***	–	.30***	−.02
8. Material rewarding	.05	.21***	−.03	.11*	.13**	.14**	.27***	–	−.09
9. Autonomy	.40***	.26***	.33***	.19***	−.26***	−.08	−.08	.00	–

Note. The coefficients above the diagonal are for mothers; those under the diagonal are for fathers.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 4
Pearson correlation coefficients examining the relations between the mothers' and fathers' first-order parenting behaviors.

	1	2	3	4	5	6	7	8	9
1. Positive parenting	.32***	.09	.16**	−.05	−.09	−.25***	−.07	−.03	.14**
2. Monitoring		.40***	.21***	.01	−.22***	−.16**	.01	.05	.15**
3. Rules			.32***	.07	−.23***	−.14**	−.09	−.12*	.18***
4. Discipline				.27***	.03	.29***	.12*	.09	.00
5. Inconsistent discipline					.22***	.12*	.07	.04	−.09
6. Harsh punishment						.83***	.21***	.14**	−.09
7. Ignoring							.23***	.06	.05
8. Material rewarding								.37***	−.07
9. Autonomy									.25***

* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 5
Results of conditional MLM of mothers' and fathers' parenting predicting changes in the developmental course of children's inhibition

Fixed effect	Mothers	Fathers
Level 1 time-varying predictors		
First-order factors		
Positive parenting	.047 (.075)	.029 (.066)
Monitoring	.086 (.032)**	.051 (.026)*
Rules	−.011 (.072)	−.003 (.070)
Discipline	−.101 (.038)**	−.006 (.034)
Inconsistent discipline	−.071 (.038)†	−.036 (.032)
Harsh punishment	.041 (.041)	.049 (.040)
Ignoring	−.056 (.036)	.013 (.026)
Material rewarding	−.010 (.041)	−.036 (.039)
Autonomy	−.053 (.040)	.026 (.042)
Second-order factors		
Support	−.028 (.093)	.074 (.065)
Negative control	−.172 (.069)*	.056 (.050)
Level 2 time-invariant covariates		
Intercept of the slope	.0302 (.0012)***	.0307 (.0014)***
Gender	.0014 (.0003)***	.0015 (.0003)***
Verbal IQ	.0006 (.0001)***	.0007 (.0001)***
Place of enrollment	−.0027 (.0004)***	−.0024 (.0004)***
First-order factors		
Mean positive parenting	.0026 (.0008)**	.0003 (.0007)
Mean monitoring	.0001 (.0004)	.0007 (.0005)
Mean rules	.0014 (.0010)	.006 (.0009)
Mean discipline	−.0008 (.0006)	−.0007 (.0006)
Mean inconsistent discipline	.0001 (.0006)	.0001 (.0006)
Mean harsh punishment	−.0003 (.0005)	.0008 (.0006)
Mean ignoring	−.0002 (.0005)	.0009 (.0005)
Mean material rewarding	−.0008 (.0005)	−.0008 (.0006)
Mean autonomy	.0005 (.0006)	−.0010 (.0007)
Second-order factors		
Support	−.001 (.001)	.000 (.001)
Negative control	−.001 (.000)†	−.000 (.001)
First-order factors Deviance	1044.74	1065.79
Second-order factors Deviance	931.79	951.01

Note. Values are coefficients with standard errors in parentheses.
† $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Table 6
Results of conditional MLM of both mothers' and fathers' parenting predicting changes in the developmental course of children's inhibition.

Fixed effect	Coefficient (*SE*)
Level 1 time-varying predictors	
First-order factors	
Mothers' positive parenting	.175 (.089)*
Mothers' monitoring	.064 (.035)†
Mothers' rules	−.067 (.088)
Mothers' discipline	−.111 (.043)*
Mothers' inconsistent discipline	−.033 (.045)
Mothers' harsh punishment	.031 (.050)
Mothers' ignoring	−.033 (.042)
Mothers' material rewarding	.028 (.049)
Mothers' autonomy	.012 (.039)
Fathers' positive parenting	.005 (.067)
Fathers' monitoring	.027 (.030)
Fathers' rules	−.014 (.077)
Fathers' discipline	.013 (.035)
Fathers' inconsistent discipline	.003 (.034)
Fathers' harsh punishment	.039 (.041)
Fathers' ignoring	.018 (.026)
Fathers' material rewarding	−.052 (.040)
Fathers' autonomy	.044 (.045)
Second-order factors	
Mothers' support	.101 (.099)
Mothers' negative control	−.180 (.070)**
Fathers' support	.035 (.065)
Fathers' negative control	.076 (.050)
Level 2 time-invariant covariates	
Intercept of the slope	.0301 (.0015)***
Gender	.0013 (.0003)***
Verbal IQ	.0005 (.0001)***
Place of enrollment	−.0025 (.0004)***
First-order factors	
Mothers' mean positive parenting	.0026 (.0009)**
Mothers' mean monitoring	−.0001 (.0005)
Mothers' mean rules	.0009 (.0011)
Mothers' mean discipline	−.0004 (.0006)
Mothers' mean inconsistent discipline	.0001 (.0006)
Mothers' mean harsh punishment	−.0004 (.0008)
Mothers' mean ignoring	−.0005 (.0006)
Mothers' mean material rewarding	−.0006 (.0005)
Mothers' mean autonomy	.0011 (.0007)
Fathers' mean positive parenting	.0008 (.0008)
Fathers' mean monitoring	.0006 (.0005)
Fathers' mean rules	.0009 (.0009)
Fathers' mean discipline	−.0010 (.0006)
Fathers' mean inconsistent discipline	.0002 (.0006)
Fathers' mean harsh punishment	.0005 (.0009)
Fathers' mean ignoring	.0006 (.0005)
Fathers' mean material rewarding	−.0006 (.0007)
Fathers' mean autonomy	−.0009 (.0007)
Second-order factors	
Mean mothers' support	−.0004 (.0011)
Mean mothers' negative control	−.0009 (.0007)
Mean fathers' support	.0001 (.0019)
Mean fathers' negative control	.0000 (.0009)
First-order factors Deviance	1116.71
Second-order factors Deviance	918.57

† $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

Results of the unconditional model

In the unconditional model testing the developmental trajectory of children's inhibition, the results of the fixed effect of the model indicated that the slope was significantly different from zero, with $B = .034$ ($SE = .001$), $p < .001$. Positive slope value (i.e., association with linear age) showed that the children's inhibition increased by .034 units per month. The results from the random section indicate significant individual variability around the slope, with random effect variance of .001, $p < .001$, and deviance of 1000.71. Therefore, it was appropriate to examine the predictors of the rates of inhibition linear change.

Results of the conditional models

The covariates that were controlled for in the conditional models were all significant, with girls having a higher rate of positive change in inhibition than boys, children with higher verbal IQ having a higher rate of positive change in inhibition, and children enrolled in randomly selected schools having a higher rate of positive change in inhibition than those enrolled in the pediatric department (Tables 5 and 6). In the conditional model computed with the nine first-order factors with the mothers only, positive change in monitoring was related to positive inhibition development. For every unit increase in mothers' monitoring (i.e., every unit deviation from the person-specific mean) over 1 month, an increase of .086 units of inhibition was evident. In contrast, for every unit increase in mothers' discipline, inconsistent discipline, and ignoring over 1 month, a decrease of .101, .071, and .056 units of inhibition, respectively, was evident. Moreover, the average level of maternal positive parenting also predicted changes in children's inhibition development. For every unit above the average level of positive parenting, an increase of .002 units of inhibition was evident. In the conditional model computed with the two second-order factors with the mothers only, for every unit increase in mothers' negative control, a decrease of .172 units of inhibition was evident. Moreover, the average level of negative control also predicted changes in children's inhibition development, with a decrease of .001 units of inhibition for every unit above the average level of negative control.

In the conditional model computed with the nine first-order factors with the fathers only, positive change in monitoring was related to positive inhibition development. For every unit increase in fathers' monitoring over 1 month, an increase of .051 units of inhibition was evident. The effect of the average level of parenting behaviors was not significant. No significant results emerged in the conditional model computed with the two second-order factors with the fathers only.

When the parents were both considered in a common model, the results showed that only maternal variables were significant. For every unit increase in mothers' positive parenting, an increase of .175 units of inhibition was found. In addition, for every unit increase in mothers' monitoring over 1 month, an increase of .064 units of inhibition was evident. In contrast, for every unit increase in mothers' discipline over 1 month, a decrease of .110 units of inhibition was evident. Moreover, the average level of maternal positive parenting also predicted changes in children's inhibition development. For every unit above the average level of positive parenting, an increase of .002 units of inhibition was evident.

Discussion

The main purpose of the current research was to test whether and to what extent parenting matters for inhibition development between 2 and 8 years of age. The relation with nine first-order and two second-order mothers' and fathers' parenting behaviors was explored. Over and above age-related improvement and the impact of the covariates (gender, verbal IQ, and place of enrollment), does parenting matter in preschoolers' inhibition development? The answer to this question is *yes*, but only to some extent. The results show that parenting does indeed matter for inhibition development. However, they also provide a nuanced picture of the parenting behaviors that are significantly associated with inhibition development in preschoolers as well as of the specific effect of mothers and fathers and their respective contributions.

First, our results confirm previous findings about the significant improvement in inhibition during the preschool period (Brooks et al., 2003; Garon et al., 2008) as well as the gender-related difference in favor of girls (Raaijmakers et al., 2008) and the positive relation between verbal IQ and EF (Matte-Gagné & Bernier, 2011). Higher verbal IQ is thought to help children organize their thinking through self-directed speech, resulting in better control of themselves and more effective planning strategies (e.g., Landry et al., 2002; Zelazo et al., 2003). For the effect of the place of enrollment, the results suggest that children enrolled by pediatricians had lower inhibition development than those enrolled in schools. This was to be expected given that the children attending the pediatric department at the university hospital who participated in this study were seeing the pediatrician because they had behavioral concerns, and these were probably related to their poorer EF.

Thanks to the separation of within- and between-person effects of the parenting variables, it was possible to demonstrate that both the way in which parents' child-rearing behaviors change over time (Level 1, i.e., mothers' and fathers' monitoring, mothers' discipline, inconsistent discipline, ignoring, and negative control) and their style of parenting (Level 2, i.e., mothers' positive parenting and negative control) were related to their children's inhibition development. Variations across measurement occasions indicated that parenting change relates to change in children's EF. In addition, the style of parenting tested in Level 2 of the models provided complementary information about the general association between parental behavior and children's EF development.

With regard to the relation between child-rearing behavior variations in the first-order factors and inhibition growth, the results support the effect of a positive change in monitoring on the part of both mothers and fathers. Parents are said to monitor when they know where their children are, who they spend time with (e.g., which peers are their friends at school), and what activities they are engaging in (e.g., what games they play, what school activities they prefer). Parents also monitor when they keep track of their children's behavior outside the home (e.g., at school). In addition, when their children have gone out somewhere on their own (e.g., to a birthday party), the parents check to see whether everything has gone all right. Conceptually speaking, maternal monitoring may cover several dimensions such as parental interest in their children and parental supervision (Meunier & Roskam, 2009). Monitoring has mainly been studied with parents of adolescents on the grounds that its operationalization requires a degree of independence and autonomy in the children. However, its validity among parents of preschoolers was supported by empirical findings among 565 mothers and fathers of 2- to 7-year-olds (Meunier & Roskam, 2009). It has also been considered as a relevant dimension of parenting for school-age children (Coley & Hoffman, 1996; Kerns, Aspelmeier, Gentzler, & Grabill, 2001; Pettit, Keiley, Laird, Bates, & Dodge, 2007). Furthermore, the developmental course of monitoring has been studied from childhood to adolescence, meaning that the construct was valid across several age periods (Pettit et al., 2007). Actually, parental monitoring is applicable in the sense of supervision and regulation strategies as soon as children participate in out-of-home activities, in particular kindergarten. The parents can gain information from multiple sources (e.g., caregivers, preschool teachers, peers) about their children's activities and companions (Crouter & Head, 2002; Pettit et al., 2007). This parenting practice is thought to help children to remain within the scope of the limits set by their parents even when they are not present to regulate the children. It has also been associated with higher security in attachment (Kerns et al., 2001), which has been found to be related to better emotional and behavioral regulation (Lay et al., 1995; Panfile & Laible, 2012; Smith et al., 2006). Its beneficial impact over time, therefore, can be understood through the gain in children's self-regulation process. Such a positive association with children's EF was illustrated in a recent study where attention problems of adolescents were related to their parents' monitoring (Bares, Delva, Grogan-Kaylor, & Andrade, 2011). Monitoring is also known to reduce children's likelihood of displaying behavioral problems (Crouter & Head, 2002; Sullivan, Childs, & O'Connell, 2010). Taking these results together might suggest that EF could play a mediational role between parental monitoring and behavioral adaptation.

Our results also support the effect of negative changes in discipline and inconsistent discipline (for mothers only) on inhibition growth. Discipline refers to the frequent use of punishment when children have done something wrong, have been agitated or impolite, or have misbehaved. Inconsistent discipline refers to threatening children with several punishments or privilege withdrawals that are not ultimately applied. The negative effect of inconsistent discipline on children's EF was previously

supported by Hughes and Ensor (2009). This negative effect can be understood as resulting from the failure of such behaviors to provide any information or assistance that could benefit children's control and coordination of goal-directed actions. In the absence of behavior that takes children's perspective and give children the opportunity to play an active role in their development, such child-rearing behaviors are shown to have a detrimental effect over time.

With regard to the effect of child-rearing behavior variations in the second-order factors on inhibition growth, the results support the deleterious effect of an increase in negative controlling on the part of mothers. Contrary to the main focus of previous literature on the influence of positive parenting, the current results indicate that negative controlling behaviors such as discipline, harsh punishment, and ignoring children are related to poor development of children's EF. Of course, the causality of the relationship we found cannot be established here based on our data. On the one hand, one could hypothesize that an increase in negative control on the part of mothers leads to slower development of the children's inhibition capacities; on the other hand, we might also hypothesize that an increase in children's inhibition capacities leads to fewer behavioral problems and, thus, a decrease in the controlling style of mothers.

With regard to the effect of parenting styles on inhibition growth, the results that were exclusively found for mothers tend to confirm the positive impact of positive parenting on average. A positive maternal attitude promoting discussion, open-ended questions, encouragement, and spending special time with children appears from our results to be a style associated with better inhibition development. Although the causal nature of this link is not established, we might hypothesize that this positive maternal attitude contributes to children's development of inhibition capacities through its ability to give an active role to children, to enable children to internalize rules and values, to coregulate children's attempts to reach their goals, and to reinforce children in case of success. This style has been previously found to be positively related to good EF in children (Hughes & Ensor, 2009). In this way, it is close to the scaffolding model where the parents provide support and treat their children as individuals with minds (Bernier et al., 2012). The results from the current study, therefore, confirm previous conclusions that maternal positive parenting is among the strongest predictors of children's EF (Bernier et al., 2010; Hughes & Ensor, 2009). The absence of a significant result from the first-order autonomy scale was surprising at first. However, autonomy in the EPEP-PPSF scale (Meunier & Roskam, 2009) is measured with only three items that are related to the extent to which the parents explicitly ask their children to behave in an autonomous way. From this point of view, the positive parenting first-order scale is clearly closer to the concepts of maternal support and sensitivity, which are crucial in the scaffolding model, than the autonomy scale. With regard to the effect of parenting style in the second-order factors on inhibition growth, the results again support the deleterious effect of a negative controlling style.

One of our ambitions in the current study was to disentangle the specific impact of mothers from that of fathers. As a main conclusion, we found that the mothers' effect on children's inhibition development was more pronounced than the fathers' effect. The range of the parenting behaviors of the mothers was wider than that of the fathers. In the common model, whereas the mothers had an impact through both their changes in positive parenting, monitoring, and discipline over time and their parenting style in positive parenting, the fathers had no significant effect either when their change in parenting over time was considered or in terms of their parenting style. Such a difference can be interpreted according to the time that the parents spend with their children. In the vast majority of Belgian families, although not in all of them, mothers still spend more time taking care of their children, but the parental involvement of mothers and fathers is also qualitatively different. For example, whereas fathers often give instrumental care, mothers provide more emotional care (Hoeve, Dubas, Gerris, van der Laan, & Smeenk, 2011). Such qualitative differences are also embedded in stereotyped roles of women and men with regard to child rearing. The style of fathering seems to bear little relation to inhibition improvement. The importance of children's effect on fathers found in previous research provides a probable explanation for this. Whereas bidirectional relations were regularly found between children's behavior and mothers' parenting, only a child effect was reported for fathers, suggesting that fathers were heavily influenced in their parenting by their children's daily behaviors (Meunier, Roskam, & Browne, 2011).

Strengths and limitations

The current study overcame several limitations of previous research by considering mothers and fathers in both separate and common models and by studying a large panel of first- and second-order parenting behaviors in a three-wave longitudinal study. The analysis strategy also gave an opportunity to work with an accelerated design for studying the developmental growth of inhibition between 2 and 8 years of age. Finally, the study made it possible to disentangle the effect of the change in parenting behaviors from that of their child-rearing styles. Although innovative and important, the current study is by no means definitive. Attempts should be made to replicate the findings using direct observations of parenting, with other culturally diverse groups of children and with clinically referred samples. In addition, other models combining mothers' and fathers' parenting should be studied as an explanation of inhibition growth (Hoeve et al., 2011). For example, one parent could enhance or decrease the other parent's effectiveness, or one parent could play a buffering role against the other parent's negative parenting. Furthermore, the effect of mothers' or fathers' parenting should be studied in relation to children's gender (Hoeve et al., 2009, 2011). Finally, this study is correlational in nature and does not make it possible to distinguish whether children's change in inhibition capacities provokes changes in parenting or the reverse (or indeed whether both of them are under the influence of an unknown third factor).

Conclusion

This study tested whether and to what extent parenting matters in preschoolers' inhibition development. It leads to the conclusion that parenting behavior is related to children's EF and development even when controlling for age-related improvement (maturation) and important covariates such as gender, verbal IQ, and place of enrollment. Mothers' parenting was found to be more related than fathers' parenting to children's EF development. More precisely, parenting behaviors that involve higher monitoring, lower discipline, inconsistency and negative controlling, and a positive parenting style are associated with good development of inhibition capacities in children. From a clinical point of view, the current study provides strong encouragement to anyone seeking to stimulate children in their EF to include the parents as active agents and to give them advice about beneficial parenting techniques.

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