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Characteristics of the First Child Predict the Parents' Probability of Having Another Child

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In a sample of 7,695 families in the prospective, nationally representative British Millennium Cohort Study, this study examined whether characteristics of the 1st-born child predicted parents' timing and probability of having another child within 5 years after the 1st child's birth. Infant temperament was assessed with the Carey Infant Temperament Scale (Carey, 1972; Carey & McDevitt, 1978) at age 9 months, childhood socioemotional and behavioral characteristics with the Strengths and Difficulties Questionnaire (Goodman, 2001), and childhood cognitive ability with the Bracken School Readiness Assessment (Bracken, 2002) test at age 3 years. Survival analysis modeling indicated that the 1st child's low reactivity to novelty in infancy, high prosociality, low conduct problems, and high cognitive ability in childhood were associated with increased probability of parents having another child. Except for reactivity to novelty, these associations became stronger with time. High emotional symptoms were also positively associated with childbearing, but this was likely to reflect reverse causality—that is, the effect of sibling birth on the 1st child's adjustment. The results suggest that child effects, particularly those related to the child's cognitive ability, adaptability to novelty, and prosocial behavior, may be relevant to parents' future childbearing.

Keywords: child effects, cognitive ability, fertility, parenting, temperament

Forty years ago Richard Bell reoriented the study of socialization and child–parent relationships by drawing attention to the fact that it is often the child who influences the parents' behavior rather than the reverse (Bell, 1968, 1979; Bell & Chapman, 1986). This line of research has been pursued particularly in studies of temperament (Kennedy, Rubin, Hastings, & Maisel, 2004; Mäntymaa, Puura, Luoma, Salmelin, & Tamminen, 2006; Verhoeven, Junger, Van Aken, Dekovic, & Van Aken, 2007; Williford, Calkins, & Keane, 2007) and behavior genetics (Krueger, Markon, & Bouchard, 2003; Lucht et al., 2006; O'Connor, Deater-Deckard, Fulker, Rutter, & Plomin, 1998) as researchers in these fields have been interested in how developmental characteristics originating from the individual modify the individual's social environment from early on. The present study explored the possibility that the influence of the first child's characteristics on parents' behavior is long-reaching enough to influence the parents' likelihood of having more children in the future.

Transition to parenthood is often greeted with excitement, enjoyment, and satisfaction. But because of the new responsibilities and demands, parents of young children tend to suffer from more psychological strain and marital dissatisfaction than people without young children (see Demo & Cox, 2000; McLanahan & Adams, 1987; Nyström & Ohrling, 2004). In making decisions about whether to have children, people seem to weigh the rewards and costs of parenthood differently depending, in part, on their personality dispositions. For instance, a recent study of personality and childbearing (Jokela, Kivimäki, Elovainio, & Keltikangas-Järvinen, 2009) showed that sociable individuals were more likely than nonsociable individuals to become parents and have a second child. Individuals with high negative emotionality, in turn, were as likely to become parents as those with low negative emotionality, but they were less likely to have a second or third child, suggesting that negative emotionality became relevant only in limiting the number of children beyond the first child. Jokela et al. (2009) suggested that persons who are prone to negative emotions may be more sensitive to parenting stress and therefore less likely to want larger families.

The experience of parenthood depends not only on the parent's but also on the child's characteristics, such as early emerging temperament traits, childhood social behaviors and emotional dispositions, and cognitive abilities. Children's negative emotionality and behavioral problems have been shown to correlate with lower parental support and harsher parenting practices (Coplan, Reichel, & Rowan, 2009; Kochanska, Friesenborg, Lange, & Martel, 2004; Neitzel & Stright, 2004; Saisto, Salmela-Aro, Nurmi, & Halmesmäki, 2008; van Bakel & Riksen-Walraven, 2002; Verhoeven et al., 2007), whereas children's positive emotionality has been related to more adaptive and supportive parenting (Kochanska et al., 2004; Neitzel & Stright, 2004). Bornstein, Hendricks, Haynes, and Painter (2007), in turn, observed that high verbal ability of the child was positively related to the child's responsiveness toward the mother's requests and to the mother's sensitivity toward the child.

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Other studies have associated various child characteristics—difficult temperament and disruptive behaviors in particular—with parenting stress, although the causal relationships between parental and child behaviors are not always clear (Burke, Pardini, & Loeber, 2008; Bussing et al., 2003; Deater-Deckard, 1998; Fite, Greening, & Stoppelbein, 2008; Lecavalier, Leone, & Wiltz, 2006). Adoption and sibling studies are particularly interesting in this context, as they are able to control some of the confounding factors arising from shared genetic and environmental factors influencing parental and offspring behavior. In an adoption study of child effects, adopted children with a genetic risk of antisocial behavior were more likely than their counterparts with no such genetic risk to receive negative parenting from their adoptive parents (O'Connor et al., 1998). Another study comparing genetically unrelated siblings demonstrated that the sibling who was rated higher in behavior problems was also regarded with more negativity and less positivity by the mother (Deater-Deckard, Smith, Ivy, & Petril, 2005). Together these studies underline the potential importance of child effects in influencing parental behavior.

It seems reasonable to hypothesize that parents' experiences with the first child influence their preferences and intentions of having another child. The present study assessed this hypothesis in the context of early emerging characteristics of the first child. In the nationally representative British Millennium Cohort Study (MCS), I examined whether infant temperament, childhood socioemotional and behavioral characteristics, and cognitive ability of the first child predicted the probability of parents having a second child within the following 5 years after the birth of the first child. I hypothesized that "easy" temperament and socially adaptive behavior (positive mood, adaptability to novelty, prosocial tendencies, absence of problem behaviors and negative mood) and high cognitive ability of the first child increase this probability, because children with such traits tend to make parenting easier. Furthermore, I expected these associations to become stronger with time because the child's traits become more clearly observable to the parents as the child grows older. I also considered the possibility of reverse causality between child characteristics and sibling birth—that is, that the birth of the second child influences emotional adjustment of the firstborn. Several sociodemographic and psychosocial background characteristics of the mother and the father (education, financial situation, psychological distress, general health, and relationship happiness) were included as covariates.

Method

Participants

The participants were from the MCS, a nationally representative British prospective study of infants born in England and Wales between September 2000 and August 2001, and in Scotland and Northern Ireland between November 2000 and January 2002. The study has been described in detail elsewhere (Dex & Joshi, 2005; Smith & Joshi, 2002). In brief, the original sample included 18,819 infants in 18,533 families (interview response rate of 85%). Households were identified through the Department of Work and Pensions Child Benefit Register (all parents of children under age 17 are eligible to receive child benefit, and coverage is estimated to be 98%). The sampling was based on probability design with clustering at the electoral ward level and overrepresentation of disadvantaged residential areas. Appropriate sampling weights were applied in all analyses to take this into account. Ethical approval for the MCS was gained from the relevant ethics committees. Parents gave informed consent before interviews took place and provided separate written consent for cognitive assessments.

The present study used data collected in home visits in three phases when the study children were, on average, 9 months, 3 years, and 5 years of age. To minimize possible confounding effects due to changing family relations (e.g., divorce of parents or presence of older siblings), I restricted the main analyses to families with two natural parents living together in the first and last study phase and with the study child as the first and only child (the less restrictive sample selection criteria used in sensitivity analyses are described in the statistical analysis section below). In the three data collection phases, 12,158, 12,285, and 14,687 families, respectively, had complete data of the study variables collected in that phase. After exclusion of families in which the parents were not living together in Phases 1 and 3, families in which the study child was not the only child, and families in which the mother was not the respondent of the parent interview, the number of eligible participants in the three phases was 11,485, 10,218, and 12,199, respectively, and the main analytic sample included the 7,695 families with complete data at each phase.

Of the included families, 7.7% were of ethnic minority (2.4% Pakistani/Bangladeshi, 1.9% Indian, 3.4% "mixed" or other ethnicity). In 91.8% of the families, only English was spoken at home; 6.8% used another language in addition to English, and 1.4% spoke only a language other than English. The most common non-English languages were Welsh (1.7% of the families), Urdu (1.4%), and a European language other than English (1.3%). Fewer than one tenth (8.5%) of the mothers had no academic qualifications, 81.1% had at least O-level education (subject-based academic qualification completed at age 15–16), and 23.6% had a university degree (first or higher degree). The corresponding percentages in fathers were 14.7%, 73.6%, and 22.7%, respectively. Family income was less than £10,400 per year in 8.0% of the families; 34.8%, 27.5%, 21.2%, and 7.9% had an annual income of £10,400–£20,800, £20,800–£31,200, £31,200–£52,000, and more than £52,000, respectively. With respect to occupational class, 29.5% of mothers and 37.9% of fathers were in managerial or professional occupations, 41.4% of mothers and 28.0% of fathers had a routine or semiroutine occupation, and the remaining 29.1% of mothers and 34.1% of fathers fell between these two categories. Most families (61.2%) were living in England, 16.0% were from Wales, 12.6% from Scotland, and 9.7% from Northern Ireland.

Infant Temperament

In the first study phase, mothers rated infant temperament on three traits (positive mood, reactivity to novelty, and rhythmicity) using 14 items from the Carey Infant Temperament Scale (Carey, 1972; Carey & McDevitt, 1978). Positive mood (5 items; Cronbach's $\alpha = .60$; all reported reliability estimates were calculated using the present data) assesses the infant's cheerfulness across a range of daily care contexts. Reactivity to novelty (5 items; $\alpha = .67$) assesses how the infant responds to environmental changes

ranging from comfortable with novelty to likely to become distressed. High scores indicate distress and withdrawal from new situations. Rhythmicity (4 items; $\alpha = .71$) indicates the extent to which the infant's physiological functions are regular and rhythmic or irregular. High scores indicate regularity. Mothers rated the items on a scale ranging from 1 (*almost never*) to 5 (*almost always*). Responses of "can't say" were coded as missing values. The resulting sum scores were scaled to range from 1 to 5.

Childhood Socioemotional and Behavioral Characteristics

In the second phase of the study, mothers were asked to complete the Strengths and Difficulties Questionnaire (SDQ; www.sdqinfo.com; Bourdon, Goodman, Rae, Simpson, & Koretz, 2005; Goodman, 1997, 2001), age 3 to 4 years version, which asks questions about six domains of behavior: conduct problems (5 items; $\alpha = .68$), hyperactivity (8 items; $\alpha = .78$), emotional symptoms (5 items; $\alpha = .52$), peer problems (5 items; $\alpha = .47$), prosociality (5 items; $\alpha = .66$), and task orientation (5 items; $\alpha = .57$). The mother rated each of the items using a 3-point scale (0 = *not true*, 1 = *somewhat true*, 2 = *certainly true*), and all the resulting sum scores were scaled to range from 0 to 10.

Childhood Cognitive Ability

During the home visit in the second study phase, cognitive assessments were carried out by trained interviewers using the Bracken School Readiness Assessment (Bracken, 2002), a validated test consisting of six subtests that assess the child's ability to identify colors, letters, numbers, and shapes and to describe and compare objects by their features. The scores ranged from 56 to 149.

Parental Characteristics

Parental characteristics included age, education, perceived financial situation, psychological distress, general health, and relationship happiness, reported at baseline. With the exception of perceived financial situation, data on all of the parental covariates were collected from both mothers and fathers. Age at baseline was determined on the basis of birth year. Education was reported on a 7-point scale of educational achievement (1 = *no academic qualifications,* 7 = *higher degree*). Perceived financial situation (reported by the mother) was reported on a 5-point scale (1 = *finding it very difficult*, 5 = *living comfortably*). I used perceived financial situation rather than reported family income because of fewer missing values, and the results were substantially the same when family income was used (data not shown). Psychological distress was assessed with the 9-item Malaise Inventory (Rutter, Tizard, & Whitmore, 1970), in which the total sum scores ranged from 0 to 9 ($\alpha = .73$ and $\alpha = .68$ for mothers and fathers, respectively). General health was reported on a 4-point scale (1 = *poor*, 4 = *excellent*). Relationship happiness was reported on a scale from 1 to 7, with high values indicating high happiness with marital relationship. Birth of the second (biological) child was determined on the basis of parents' reports of their children's birth dates (year and month) in the last follow-up phase. Family ethnicity was coded as a dichotomous variable (0 = *neither of the parents belongs to an ethnic minority group*, 1 = *either or both parents belong to an ethnic minority group*).

Statistical Analysis

The parents' timing and probability of having the second child was assessed with discrete-time survival analysis. The follow-up period (determined to start from the first child's birth month) spanned from 53 to 70 months ($M = 62.6$ months, $SD = 2.9$), and families were right-censored (i.e., excluded from the analytic sample) at the age their first child was in the final follow-up phase, as I did not know whether the parents had a second child after this. For the statistical analyses, I recoded the time variable into 4-month periods. A preliminary analysis of the sample hazard function of having the second child suggested a bell-shaped curve with a slight positive skew, so the hazard functions were modeled with linear and quadratic terms of square-root transformed indicators of time (the latter, of course, being equal to nontransformed time). To assess the hypothesis that associations between child characteristics and parents' timing of their second child changes with time, I tested for interaction effects between child characteristics and linear time indicator. The interaction effects were illustrated by plotting the predicted hazard functions by different levels of child characteristics (from 1 *SD* below the mean to 1 *SD* above the mean). The regression coefficients were expressed as odds ratios (OR) indicating the difference in hazard function (i.e., probability of having the second child at a given time for parents who had not had the second child by that time) associated with one unit difference in the predictor. The effect magnitudes were illustrated by calculating the predicted cumulative probabilities (= 1 − value of predicted survivor function at the end of the follow-up period) of having the second child during the follow-up period by different levels of first child's temperament, socioemotional and behavioral characteristics, and cognitive ability.

In addition to the main analyses, the robustness of the results was explored with two sets of sensitivity analyses. First, to examine potential bias introduced by sample selection, I fitted the models separately for infant temperament, childhood socioemotional and behavioral characteristics, and cognitive ability in all one-child families with relevant data available on these measures even if they did not have data on all child or parental characteristics (n = 11,262–13,428, depending on the variables included in the models). Second, to exclude the possibility of reverse causality—that is, the birth of the second child influencing characteristics of the first child assessed in Phase 2, I fitted the survival analysis models in families in which the second child had not been born before the assessment of the first child's childhood characteristics (n = 5,086). These sensitivity analyses largely replicated the main findings and are presented in detail in the Results section.

Results

Table 1 shows the descriptive statistics for the included and excluded participants. Compared with the excluded families, the included families were more educated, were less likely to be of ethnic minority, had older mothers, and were more likely to have a second child during the follow-up. The firstborn children of the included families had moderately higher cognitive ability and lower problem behaviors than the excluded children. In addition,

Table 1
Descriptive Statistics for the Sample

Variable	Included (n = 7,695)	Excluded (n = 5,058–10,857)	Difference in units of *SD*s or % points[b]
Having a second child during the follow-up[a]	42.4	35.6	6.8
First child			
Sex (girls)[a]	49.8	47.8	2.0
Age at baseline (months)	9.2 (0.5)	9.2 (0.6)	−0.10
Ethnic minority[a]	7.7	24.2	16.5
Infancy: Positive mood	3.9 (0.7)	3.8 (0.7)	0.04
Infancy: Reactivity to novelty	1.9 (0.7)	2.1 (0.8)	−0.18
Infancy: Rhythmicity	4.4 (0.7)	4.2 (0.8)	0.27
Childhood: Emotional symptoms	1.2 (1.4)	1.5 (1.6)	−0.22
Childhood: Conduct problems	2.6 (1.9)	3.1 (2.2)	−0.26
Childhood: Hyperactivity	4.0 (2.1)	4.6 (2.2)	−0.26
Childhood: Peer problems	1.3 (1.5)	1.8 (1.6)	−0.27
Childhood: Prosociality	7.4 (1.8)	7.3 (2.0)	0.08
Childhood: Task orientation	7.6 (1.6)	7.4 (1.8)	0.13
Childhood: Cognitive ability	107.0 (15.5)	99.0 (16.2)	0.49
Mother			
Age at baseline (years)	30.9 (5.2)	28.7 (6.3)	0.38
Education	3.7 (1.8)	2.5 (2.0)	0.60
Psychological distress	1.5 (1.6)	1.8 (1.9)	−0.18
General health	2.2 (0.7)	2.0 (0.8)	0.22
Relationship happiness	5.7 (1.4)	5.7 (1.5)	0.06
Perceived financial situation	2.9 (0.9)	2.5 (1.0)	0.37
Father			
Age at baseline (years)	33.5 (5.9)	32.9 (6.8)	0.10
Education	3.4 (2.1)	2.7 (2.2)	0.34
Psychological distress	1.3 (1.5)	1.4 (1.6)	−0.08
General health	2.2 (0.7)	2.1 (0.8)	0.15
Relationship happiness	4.7 (1.9)	4.8 (1.8)	−0.05

Note. Values are means (and standard deviations) unless otherwise indicated.
[a] Values are percentages of participants. [b] Values are difference scores between included and excluded participants in units of standard deviation (*SD*; for continuous variables) or percentage points (for categorical variables). Differences are calculated from exact values rather than rounded values presented in the table. Positive values indicate higher values in included than excluded participants. The group of excluded participants comprises those for whom data were available at the assessment study phase but who did not fulfill the sample selection criteria.

for most variables the standard deviations were slightly higher in the excluded than in the included participants, suggesting smaller interindividual variation in the latter group. Table 2 presents the correlations between independent variables. Childhood socioemotional and behavioral characteristics exhibited weak continuity with infant temperament, and high cognitive ability was predicted by low reactivity to novelty and high rhythmicity. Of the child measures, childhood emotional symptoms, conduct problems, and hyperactivity showed the strongest associations with parental characteristics—maternal psychological distress in particular.

Figure 1 plots the sample hazard function for the birth of the second child. Counting from the birth date of the first child, this probability increased up to ~2.5 years, after which it began to decrease, the average interbirth interval between the first and second child being 2.7 years. With respect to parental characteristics, the probability of childbirth was increased by high education and good financial situation, low psychological distress and good general health, and by high relationship happiness (see Table 3). These associations were quite similar for mothers and fathers, although somewhat weaker among the latter. None of the interaction effects with these characteristics and time were statistically significant (all p values $> .09$), indicating that they predicted the second child's birth with a constant effect size over the follow-up period. Mutually adjusting for all the mother's and father's characteristics attenuated especially the effects of mother's psychological distress, father's general health, and father's relationship happiness. The rightmost column of Table 3 shows the estimated effect sizes expressed as the predicted difference in the absolute probability of having a second child during the follow-up period associated with one standard deviation of the variable. For instance, one standard deviation difference in mother's relationship happiness was associated with a 5.1 percentage point difference in the probability of having a second child.

Next I assessed the associations between child characteristics and birth of the second child in separate univariate models (see Table 4). Low reactivity to novelty in infancy, high emotional symptoms, high prosociality, low conduct problems, and high cognitive ability in childhood were associated with parents' higher probability of having a second child, and significant interaction effects with time indicated that the strength of these associations changed over time. To illustrate the time-dependent patterns, I plotted the predicted hazard functions by different levels of child traits (see Figure 2). Infant reactivity to novelty and emotional symptoms were associated with early childbearing probability, but their effects attenuated with time. By contrast, prosociality, conduct problems, and cognitive abil-

Table 2
Correlations Between Independent Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1. Sex (0 = male, 1 = female)	—																					
2. Ethnic minority	1	—																				
3. Infancy: Positive mood	0	−5	—																			
4. Infancy: Reactivity to novelty	6	13	−17	—																		
5. Infancy: Rhythmicity	1	−17	11	−5	—																	
6. Childhood: Emotional symptoms	0	10	−9	15	−12	—																
7. Childhood: Conduct problems	−6	2	−10	8	−14	27	—															
8. Childhood: Hyperactivity	−13	4	−8	6	−12	26	56	—														
9. Childhood: Peer problems	−6	11	−8	11	−14	32	25	23	—													
10. Childhood: Prosociality	12	1	14	−6	4	−8	−32	−27	−28	—												
11. Childhood: Task orientation	10	−5	10	−7	4	−12	−11	−20	−17	28	—											
12. Childhood: Cognitive ability	12	−11	−2	−8	11	−13	−19	−23	−15	11	12	—										
13. Mother: Age	2	−4	−3	−1	4	−9	−17	−20	−9	−3	−1	15	—									
14. Mother: Education	0	−5	−5	−8	12	−15	−21	−22	−15	5	6	31	26	—								
15. Mother: Psychological distress	−1	5	−11	12	−13	19	23	20	15	−7	−5	−8	−7	−10	—							
16. Mother: General health	−1	−5	7	−8	10	−10	−17	−16	−11	7	4	12	8	18	−37	—						
17. Mother: Relationship happiness	−1	1	10	−5	6	−7	−11	−8	−7	6	5	3	5	3	−25	14	—					
18. Mother: Financial situation	−1	−6	6	−6	8	−9	−14	−13	−9	3	1	16	12	22	−22	22	12	—				
19. Father: Age	1	0	−2	1	2	−7	−13	−15	−6	−2	0	11	66	17	−8	7	4	8	—			
20. Father: Education	0	0	−3	−4	8	−10	−16	−19	−12	3	3	30	25	50	−9	15	5	21	15	—		
21. Father: Psychological distress	−2	2	−4	3	−4	8	13	10	5	−3	−2	−8	−9	−9	18	−12	−13	−17	−6	−11	—	
22. Father: General health	1	−4	1	−3	4	−7	−10	−9	−8	5	3	9	6	14	−12	15	8	15	−1	16	−31	—
23. Father: Relationship happiness	−1	2	3	−1	−1	−1	−2	0	0	3	2	−3	1	−2	−8	6	14	3	4	−6	−12	7

Note. Values are Pearson correlation coefficients multiplied by 100. All correlations with $|rx100| > 2$ are statistically significant ($p < .05$). $N = 7{,}695$.

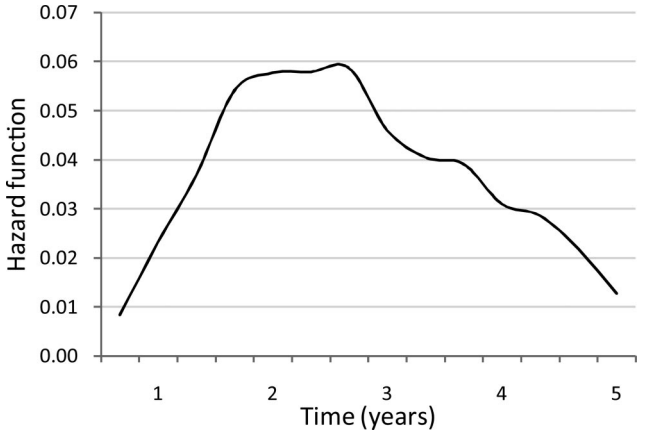

Figure 1. Sample hazard function for the birth of the second child, by age of the first child. The hazard function denotes the probability of having the second child at a given age in parents who have not yet had the second child by that age.

ity became stronger predictors with time. Note that the hazard functions assess relative differences associated with the independent variables, which is why the lines would visually show more marked differences at higher levels of childbearing probability (midpoint of the bell curve) even if there were no interaction effects between predictors and time. The significant interaction effects indicated that these relative differences attenuated or strengthened over time.

I then included all of the five statistically significant characteristics in a single multivariate survival analysis model (see Table 5). In this model, the conduct problems variable was no longer statistically significant (main effect: OR = 1.07, $p = .54$, 95% CI [0.87, 1.31]; interaction effect with time: OR = 0.96, $p = .35$, 95% CI [0.89, 1.04]), so this trait was omitted from the final multivariate model. Other associations remained at least marginally significant when mutually adjusted (Model 1). Compared with low (−1 *SD*) levels of the trait, the first child's high (1 *SD*) reactivity to novelty, emotional symptoms, prosociality, and cognitive ability changed the parents' probability of having the second child during the follow-up period by −5.9, 4.4, 2.5, and 13.9 percentage points, respectively. Adjusting for all parental characteristics attenuated and amplified these differences to −5.0, 6.6, 1.0, and 8.2 percentage points, respectively. When the statistically nonsignificant conduct problems variable was included in the multivariate model, the corresponding unadjusted and adjusted effect sizes for this trait

Table 4
Predicting the Birth of the Second Child, by Characteristics of the First Child

Characteristic	Main effect	Interaction effect with time
Sex (0 = Male, 1 = Female)	0.90* [0.83, 0.98]	—
Infancy: Positive mood	1.01 [0.97, 1.06]	—
Infancy: Reactivity to novelty	0.74** [0.61, 0.89]	1.08* [1.00, 1.16]
Infancy: Rhythmicity	1.02 [0.97, 1.08]	—
Childhood: Emotional symptoms	1.29* [1.06, 1.56]	0.92* [0.86, 0.99]
Childhood: Conduct problems	0.96 [0.91, 1.01]	0.95* [0.90, 0.99]
Childhood: Hyperactivity	0.96 [0.92, 1.01]	—
Childhood: Peer problems	1.00 [0.95, 1.05]	—
Childhood: Prosociality	0.86 [0.72, 1.03]	1.09* [1.01, 1.17]
Childhood: Task orientation	0.96 [0.91, 1.01]	—
Childhood: Cognitive ability	1.01 [0.83, 1.23]	1.09* [1.01, 1.17]

Note. Values are standardized odds ratios (and 95% confidence intervals in parenthesis) of discrete-time survival analysis fitted separately for each child characteristic. All models adjust for child's age at assessment, child's sex and ethnicity, mother's age at baseline, time and time^2. Interaction effect with time is included only if statistically significant ($p < .05$). N = 7,695.
* $p < .05$. ** $p < .01$.

Table 3
Predicting the Birth of the Second Child, by Parent Characteristic

Parent characteristic	Model 1	Model 2	Model 3	Effect size (% points)[a]
Mother				
Age at baseline (years)	0.94*** [0.93, 0.94]	0.92*** [0.91, 0.93]	0.93*** [0.92, 0.94]	−9.6
Education	1.18*** [1.15, 1.21]	1.17*** [1.14, 1.20]	1.12*** [1.09, 1.15]	9.9
Psychological distress	0.94*** [0.91, 0.96]	0.99 [0.96, 1.02]	1.00 [0.97, 1.03]	−3.2
General health	1.29*** [1.21, 1.37]	1.19*** [1.11, 1.27]	1.16*** [1.08, 1.24]	5.7
Relationship happiness	1.12*** [1.08, 1.16]	1.10*** [1.06, 1.14]	1.09*** [1.05, 1.13]	5.1
Perceived financial situation	1.19*** [1.13, 1.24]		1.08*** [1.03, 1.13]	5.2
Father				
Age at baseline (years)	0.95*** [0.94, 0.95]	0.94*** [0.94, 0.95]	0.97*** [0.96, 0.98]	−9.1
Education	1.11*** [1.08, 1.13]	1.10*** [1.08, 1.13]	1.07*** [1.05, 1.10]	6.8
Psychological distress	0.93*** [0.90, 0.96]	0.95* [0.92, 0.98]	0.97* [0.94, 0.99]	−3.3
General health	1.16*** [1.09, 1.23]	1.07* [1.01, 1.14]	1.04 [0.98, 1.11]	3.3
Relationship happiness	1.03* [1.01, 1.05]	1.03* [1.01, 1.05]	1.01 [1.00, 1.04]	1.7

Note. Values are odds ratios (and 95% confidence intervals in brackets) of discrete-time survival analysis. All models adjust for parent's age at baseline, ethnicity, time, and time^2. Model 1: univariate associations of the covariates. Model 2: mutually adjusted associations fitted separately in mothers and fathers (mother-reported perceived financial situation is not included in the mothers' model so that the mothers' and fathers' models would be comparable). Model 3: all covariates of mothers and fathers mutually adjusted.
[a] Effect size (% points): The predicted difference in the absolute probability of having a second child during the follow-up period associated with one standard deviation of the variable, calculated from Model 1. N = 7,695.
* $p < .05$. *** $p < .001$.

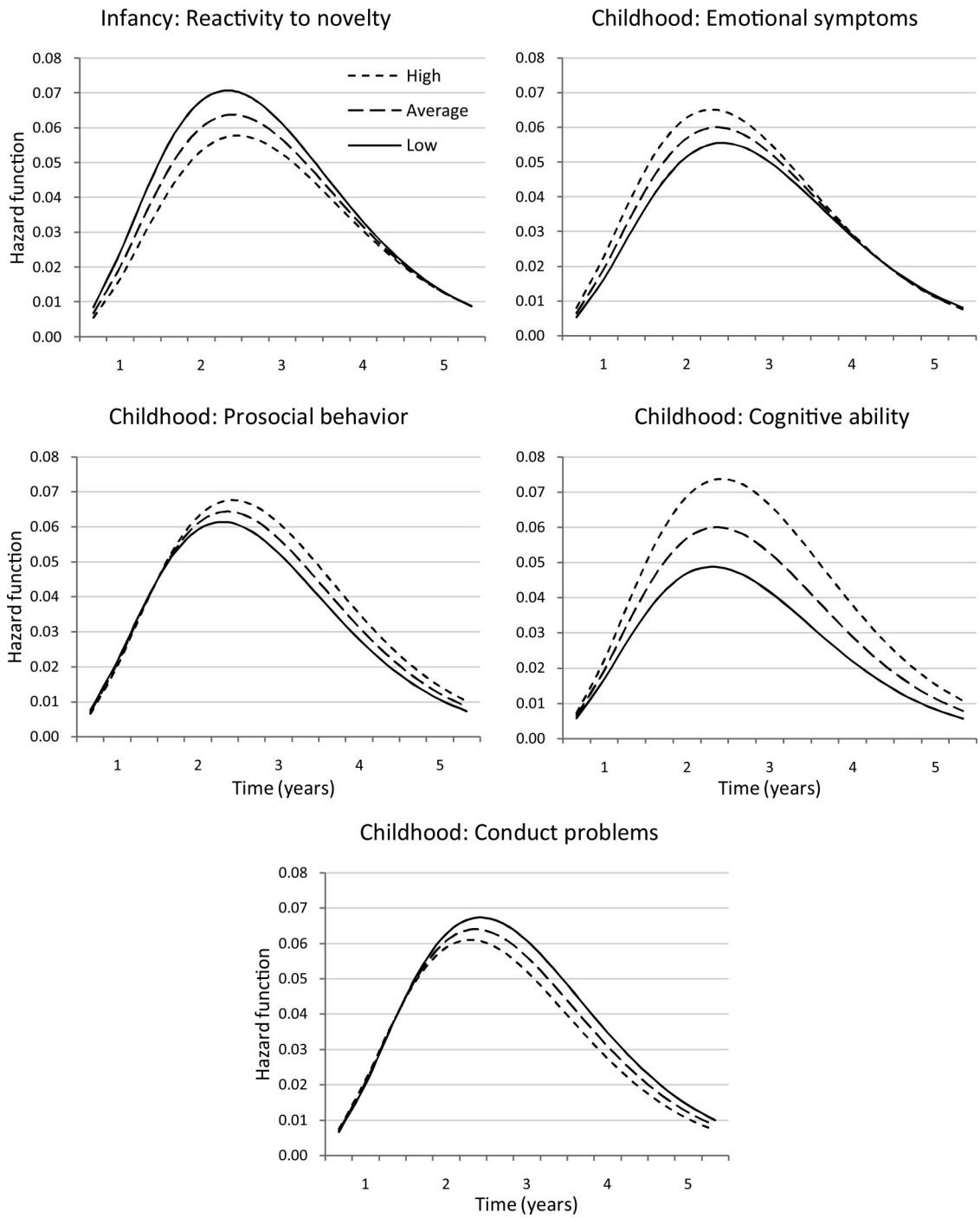

Figure 2. Predicted hazard functions for the birth of the second child, by age and characteristics of the first child (Low = 1 *SD* below the mean; Average = mean; High = 1 *SD* above the mean). The hazard functions denote the probability of having the second child at a given age in parents who have not yet had the second child by that age.

were −2.2 and −1.1 percentage points, respectively, suggesting similar effect sizes for conduct problems and prosociality despite the fact that only the latter reached statistical significance in the multivariate model.

Sensitivity Analyses

First, I examined whether the results were similar when all families with relevant child data were included, irrespective of

Table 5
Predicted Probabilities of Having the Second Child by the End of the Follow-Up Period, by Characteristics of the First Child

Characteristic	Predicted probability (%)[a]			Regression coefficient[b]	
	Low	Average	High	Main effect	Interaction effect
Not adjusted for parental characteristics					
Infancy: Reactivity to novelty	43.3	40.3	37.5	0.71** [0.58, 0.86]	1.10* [1.02, 1.19]
Childhood: Emotional symptoms	38.2	40.3	42.5	1.34** [1.10, 1.63]	0.92* [0.85, 0.99]
Childhood: Prosociality	39.1	40.3	41.6	0.85† [0.71, 1.02]	1.08* [1.00, 1.16]
Childhood: Cognitive ability	33.7	40.3	47.6	1.04 [0.85, 1.27]	1.08† [1.00, 1.16]
Adjusted for parental characteristics					
Infancy: Reactivity to novelty	42.3	39.7	37.3	0.72** [0.59, 0.88]	1.09* [1.01, 1.18]
Childhood: Emotional symptoms	36.6	39.7	43.1	1.37** [1.13, 1.68]	0.92* [0.85, 0.99]
Childhood: Prosociality	39.3	39.7	40.3	0.84† [0.79, 1.01]	1.08* [1.00, 1.16]
Childhood: Cognitive ability	35.8	39.7	44.0	0.93 [0.76, 1.14]	1.08* [1.00, 1.17]

[a] Values are predicted probabilities (%) of parents having the second child by the end of the follow-up period by levels of the first child's characteristics (Low = 1 *SD* below the mean; Average = Mean; High = 1 *SD* above the mean). [b] Values are standardized odds ratios (95% confidence intervals in brackets) of mutually adjusted discrete-time survival analysis models. All models are adjusted for the first child's sex, age at assessment, ethnicity, mother's age, time and time^2. Parental characteristics include the mother's and the father's age, education, perceived financial situation (mother only), psychological distress, general health, and relationship happiness (see Table 3). N = 7,695.
† $p < .10$. * $p < .05$. ** $p < .01$.

baseline family constellation and availability of other data (indicator of baseline marital status was entered as a covariate in all the models; 0 = two parents, 1 = single parent). Phase 3 data on the second child were available for 13,894 families, of which 13,428 had data on infant measures and 11,262–11,984 had data on childhood measures. As expected, the differences in child and parent characteristics between included and excluded participants were substantially smaller in the sensitivity analysis sample than in the main sample (data not shown) because in the latter case more socially disadvantaged families were excluded, whereas in the former case only those lost to follow-up were excluded. When the unadjusted model in Table 5 was refitted with the sensitivity analysis sample, the average probability of birth of the second child was 37.6%. All of the time-dependent associations between child characteristics and birth of the second child (see Table 4) yielded statistically significant results that were substantially the same as in the main analysis (data not shown). Compared with low (−1 *SD*) levels of child characteristics, the first child's high (1 *SD*) reactivity to novelty, emotional symptoms, prosociality, and cognitive ability were associated with −4.4, 3.5, 1.8, and 12.1 percentage points differences, respectively, in the probability of the birth of the second child, suggesting similar but slightly smaller effect sizes in the sensitivity analysis compared with the main analysis.

Childhood characteristics of the first child were assessed at age 3 when some of the parents had already had their second child. Thus, the results of childhood characteristics might have been confounded by reverse causality—that is, the birth of the second child might influence the first child's characteristics rather than the reverse. To exclude this possibility, I fitted the survival analysis models in families who had not had their second child before the second study phase (n = 5,086). In these analyses, time was modeled with linear term only (as the hazard function decreased fairly linearly after 3 years), and no interaction effects between time and first child's characteristics were included because of the limited time span. As could be expected on the basis of the time-dependent associations (shown in Figure 2), the variable emotional symptoms was not statistically significant (p = .79). However, prosociality (OR = 1.10, p = .07, 95% CI [0.99, 1.21]), conduct problems (OR = 0.88, p = .02, 95% CI [0.79, 0.98]), and cognitive ability (OR = 1.20, $p < .001$, 95% CI [1.08, 1.34]) were all associated with parents' childbearing, supporting the robustness of the results in a completely prospective study setting. It may be noted at this point that studies of siblinghood often find negative associations between sibling birth and socioemotional and cognitive development of the first child (Baydar, Greek, & Brooks-Gunn, 1997; Downey, 2001; Volling, 2005), which is in contrast to the present associations between the characteristics of the firstborn and birth of the second child, which were mainly positive. Thus, the possibility of confounding due to reverse causality appears unlikely, except for emotional symptoms, as discussed below.

Discussion

The present study suggests that parents' timing and probability of having their second child may depend on characteristics of the first child. The first child's low reactivity to novelty in infancy and high prosociality, low conduct problems, and high cognitive ability in childhood were associated with increased probability of parents having another child. High versus low level of infant reactivity to novelty was associated with a −5.9 percentage point difference in the parents' probability of having a second child during the 5 years after the birth of the first child, the corresponding percentage points being 2.5 for prosocial tendencies, −2.2 for conduct problems, and 13.9 for cognitive ability. Except for cognitive ability, the overall effect sizes for child characteristics were relatively modest compared with those for parental characteristics. High versus low levels of parental characteristics were associated with 3 to 20 percentage point differences in childbearing probability, with an average of 13 and 10 percentage points for maternal and paternal characteristics, respectively. However, the somewhat low reliabilities of child measures may have underestimated the influence of child effects on parental childbearing.

High emotional symptoms of the first child were also positively associated with birth of the second child, but this association was more likely to reflect reverse causality—that is, the first child's response to having a sibling born in the family. Adjusting for the mother's and father's age, education, financial situation, psychological distress, general health, and relationship happiness did not substantially alter the main results.

Main Findings

Infants with low reactivity to novelty adapt more quickly to unfamiliar situations, places, and persons, and are less prone to distress than infants with high reactivity (see Fox, Henderson, Marshall, Nichols, & Ghera, 2005; Kagan, 1997). Thus, the observed association between the first child's adaptability to novelty and parents' increased probability of childbearing may be attributable to the fact that low-reactive infants make parenting seem easier than high-reactive infants do. The time-dependent relationship for this trait was not as I hypothesized a priori, as the association was observed for early but not late childbearing, but this time-dependent effect is easily interpreted. Although temperament traits show moderate continuity over time even in early childhood (e.g., Pfeifer, Goldsmith, Davidson, & Rickman, 2002), infant reactivity to novelty may lose its salience in affecting parents' behavior as the child grows older. When it comes to parents' intentions of having another child, it seems that a highly reactive firstborn postpones this decision but that the memories of challenges with such a firstborn tend to fade away with time.

High childhood prosociality and low conduct problems predicted increased probability of parents' childbearing, and these two traits showed the hypothesized time-dependent pattern—that is, they became stronger predictors with time. Children with high prosocial tendencies are likely to be more cooperative with their parents and to elicit more nurturing parenting than children with low prosocial tendencies (cf. Kochanska et al., 2004; Neitzel & Stright, 2004; O'Connor et al., 1998). Positive experiences with prosocial children may therefore increase parents' preference for having more children. It is worth noting that, despite the high correlation between conduct problems and hyperactivity, the latter trait was not associated with parental childbearing. This suggests that the antisocial component of conduct problems may be more important in influencing parental childbearing decisions than the component related to behavioral disinhibition and impulsivity.

Childhood emotional symptoms showed a somewhat unexpected pattern of results. High emotional symptoms were associated with increased (rather than decreased) probability of birth of the second child, and this association decreased (rather than increased) with time. It is possible that some facets of emotional reactivity—especially fearfulness—elicit more protective and responsive parenting (Kochanska et al., 2004; van Bakel & Riksen-Walraven, 2002) and facilitate the child's development of compliance and conscience (Kochanska, 1997; Leve, Scaramella, & Fagot, 2001). These associations might contribute to a positive association between the first child's emotional symptoms and parents' future childbearing. However, it seems more plausible that the association reflects reverse causality, as it was observed only for sibling birth before age 3 (when emotional symptoms were assessed) but not after. In addition, high infant reactivity to novelty, which was correlated positively with later emotional symptoms, was associated with lower rather than higher probability of parental childbearing. In previous studies (e.g., Baydar et al., 1997), birth of a sibling has been shown to increase the risk of socioemotional maladjustment in the firstborn, which would be in agreement with the reverse causality interpretation.

Compared with studies of temperament and behavior problems, there seem to be relatively few studies that have examined child effects related to cognitive ability and parenting. Existing evidence suggests that children with high cognitive ability are more responsive toward their parents and are treated with greater parental sensitivity (Bornstein et al., 2007; Verhoeven et al., 2007; see also Fuligni, Han, & Brooks-Gunn, 2004; van Bakel & Riksen-Walraven, 2002). Cognitive ability has also been associated with greater child compliance (van der Mark, Bakermans-Kranenburg, & van Ijzendoorn, 2002). In the present study, high cognitive ability of the first child predicted higher probability of parents' childbearing even more strongly than emotional, behavioral, and social characteristics did, and this association increased with time as hypothesized. Adjusting for parental characteristics attenuated the association partly but not completely. These findings indicate that the first child's high cognitive ability may facilitate the parents' intentions of having another child, perhaps due to its positive correlates with social behavior and parent–child relationships.

Infant positive mood and rhythmicity, and childhood hyperactivity, task-orientation, and peer problems were unrelated to parents' childbearing probability, indicating that not all child characteristics potentially related to parenting are equally important in predicting parental childbearing. Together the findings suggest that cognitive ability, adaptability to novelty, and prosocial behaviors (high prosociality and low conduct problems) may be the most important characteristics to influence parents' decision of having more children. I hypothesize that this is because such child characteristics make parenthood easier, less stressful, and perhaps more rewarding, thereby increasing parents' intentions of having more children. Obviously, more data with different child and parent measures are needed before such a general conclusion can be drawn with confidence.

Other Results

Infant temperament showed several expected associations with childhood behaviors assessed at age 3. Infants who exhibited high positive mood were more likely to be prosocial and task orientated, and to have fewer behavioral problems in childhood. High reactivity to novelty predicted childhood emotional symptoms and peer problems in particular, and low infant rhythmicity was consistently associated with higher rates of childhood behavioral problems (conduct problems, hyperactivity, and peer problems) and negative emotionality. It is interesting that childhood cognitive ability was predicted by low reactivity to novelty and high rhythmicity. Previous research has suggested that adaptability to novelty may facilitate cognitive development (Raine, Reynolds, Venables, & Mednick, 2002), but there appears to be no studies of rhythmicity and cognitive development. The association between temperament and cognitive development will be explored in more detail in future studies of the cohort.

In agreement with previous findings of child behavior and parenting stress (e.g., Burke et al., 2008; Coplan et al., 2009; Deater-Deckard, 1998; Neitzel & Stright, 2004), childhood char-

acteristics most strongly correlated with mother's psychological distress were related to disruptive behaviors (conduct problems and hyperactivity) and negative emotionality (emotional symptoms). Maternal distress was also related to "difficult" aspects of infant temperament—that is, low positive mood, high reactivity to novelty, and low rhythmicity. These associations may reflect (a) the mother's influence on the child behavior, (b) the child's influence on the mother's distress, or (c) common environmental or genetic influences on the child and the mother, but it was beyond the scope of the present study to evaluate these alternatives. The associations between child characteristics and father's psychological distress were qualitatively similar but considerably weaker than those observed in mothers. This difference may due to the fact that mothers tend to be more involved than fathers in caring for children, although the possibility of common informant bias cannot be excluded as child characteristics were assessed by mothers.

Demographers have long been interested in offspring sex preferences and have studied this by examining how the sex distribution of previous offspring conditions parents' future childbearing (Hank & Kohler, 2000). The approach is based on the assumption that parents who do not have children of their preferred sex are more likely to have another child. In the present sample, parents whose first child was a boy were more likely to have a second child than those with a girl, pointing toward a daughter preference. However, two reservations to this interpretation need to be made. First, the assumption underlying offspring sex preference research may not be completely valid. As shown by the present findings, child characteristics that parents are likely to prefer may increase rather than decrease parents' decision of having more children. This renders the interpretation of reproductive patterns conditioned by offspring sex equivocal. Second, I assessed the birth only of the second child, which did not allow me to examine more complex preferences—for example, a preference to have a balanced number of both sons and daughters. This preference would become apparent only with larger family sizes, and it has been the most common preference observed in many European countries (Hank & Kohler, 2000). Hence, the present result related to gender preference should be interpreted only as suggestive.

Findings related to parental characteristics are also worth noting. First, higher education increased the probability of having a second child. This association may appear to go against the nearly universal correlation between high education and low fertility in industrialized societies (Skirbekk, 2008), but other studies in Britain have also demonstrated that among parents who already have one child, more educated women have their second child more quickly than less educated women (Berrington, 2004; Rendall & Smallwood, 2003; see also Gerster, Keiding, Knudsen, & Strandberg-Larsen, 2007; Kravdal, 2007). The overall correlation between education and completed fertility is still negative because of the effect of high education of delayed childbearing (Berrington, 2004; Rendall & Smallwood, 2003). Good financial situation also increased the probability of childbearing.

Second, parents' good general health, low psychological distress, and high relationship happiness increased the probability of childbearing. These findings are rather intuitive and may strike many even as self-evident, but their relevance should not be overlooked. As noted by Basu (2006), much of demographic research has emphasized rationality at the expense of emotions and other psychological phenomena in explanations of reproductive behavior, which has limited the psychological understanding of demographic processes (see Hobcraft, 2006). Together with earlier studies of personality and fertility (e.g., Elder & Macinnis, 1983; Jokela, Hintsa, Hintsanen, & Keltikangas-Järvinen, 2010; Jokela & Keltikangas-Järvinen, 2009; Jokela et al., 2009; Roberts & Bogg, 2004), the present findings emphasize the importance of a multidisciplinary approach to studying fertility behavior.

Strengths and Limitations

This study has several strengths. First, it is based on a large and nationally representative sample with a prospective follow-up. Second, characteristics of the first child were assessed with validated instruments in infancy and early childhood. Third, the use of survival analysis methodology allowed me to examine the time-dependent nature of child effects. Fourth, I was able to adjust for several psychosocial and socioeconomic characteristics of both the mother and the father.

There are some methodological limitations that need to be taken into account in interpreting the present data. Being based on observational rather than experimental data, the study is limited in drawing conclusive causal inferences. In particular, it is possible that the child characteristics reported by the mother are confounded by parental characteristics, and that the observed associations reflect the influence of parental rather than child effects. The fact that the associations between child characteristics and parental childbearing changed as a function of time in theoretically meaningful ways provides indirect evidence for the child-effect interpretation, as no such time-dependent associations were observed for any of the parental characteristics. Although adjusting for all possible parental characteristics (e.g., personality, cognitive ability) might have attenuated the associations, this would not have solved the issue of causality; parental and offspring characteristics are influenced by shared genetic factors, so adjusting for all parental characteristics might result in an overadjustment of child effects.

On the other hand, one may argue that the use of parental reports is not a major limitation in the present context, as it is the parents' perceptions of their firstborn child that are important in influencing experiences of parenthood. Studies with multiple-informant assessment of child characteristics would be valuable in examining the relative importance of objectively assessed and subjectively perceived child characteristics in predicting parents' future childbearing. In addition, experimental trials aimed at enhancing cognitive development or changing social behavior of children in early childhood might be fruitfully applied to provide more robust evidence for causality of child effects. Such data might already be available in existing trials if these studies have included sufficient background data on family constellations.

Recent research on the determinants of parenting has emphasized the complex interplay between characteristics of the child, parents, and social environment (Belsky, 1984; Bornstein et al., 2007; Paulussen-Hoogeboom, Stams, Hermanns, & Peetsma, 2008; Verhoeven et al., 2007). The present study was primarily focused on the role of child characteristics as determinants of parents' childbearing. Future studies should broaden this perspective to include other relevant dimensions. In particular, it would be valuable to examine whether specific dimensions of parental behaviors and attitudes that parents adopt with their first child predict

future childbearing and whether these parenting behaviors mediate the child effects. And although I have mainly discussed how experiences with the first child might influence parents' family planning and fertility preferences directly, it is equally possible that child characteristics influence parental childbearing indirectly, for instance, by interfering with the parents' sexual, marital, and family life.

Conclusion

Findings from a large, nationally representative British birth cohort of children and their parents suggest that characteristics of the firstborn child may influence the parent's timing and likelihood of having a second child. High cognitive ability, high infant adaptability to novelty, and high childhood prosocial behavior of the first child predicted increased probability of the parents having a second child during a 5-year follow-up period. Within the methodological limitations of an observational study, the results provide novel evidence for the role of child effects in parental behavior.

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