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The Associations of Birth Order with Personality and Intelligence in a Representative Sample of
U.S. High School Students

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Abstract

We tested birth order associations with personality traits and intelligence using Project Talent, a representative sample ($N = 377,000$) of U.S. high school students. Using a between-family design and several background factors (i.e., age, sex, sibship size, parental socio-economic status, and family structure), we were able to control for potential confounds, and estimate the links between birth order and outcomes across several different social categories. In addition to differences between firstborns and laterborns across the entire sample, we also tested birth rank trends in a sub-sample of targets from sibships of three, raised by two parents. Overall, the average absolute association between birth order and personality traits was .02, whereas the one between birth order and intelligence was .04.

Keywords: birth order; personality; Project Talent; intelligence; family background

1. Introduction

Birth order is a human experience that is one of the most pervasive and universally thought to determine who we are (Sulloway, 1996). The debate over the association of birth order with personality and intelligence has spawned continuous interest over the past hundred years, both from the general public and from scientists. Books on birth order and why it matters for children's personality, intelligence, development, and future success are among the top bestselling parenting books. And yet, among scientists, despite a consistent stream of research on birth order, results remain inconclusive and controversial. The present study uses the largest representative sample of U.S. students ever employed to help answer questions regarding the magnitude of associations between birth order, personality, and intelligence.

1.1. Theoretical background

Theories of the link between birth order and personality were at the core of one of the most heated scientific disputes of all time, between Sigmund Freud and Alfred Adler. To Freud's outrage, Adler (a middle child himself) maintained that first- and lastborn children suffer from neuroses caused by their constant struggle for success and superiority, whereas middle children are healthier, easy going, and rebellious (Adler, 1928). Not surprisingly, Freud (a firstborn child himself) felt threatened by Adler's idea, so the dispute ended in Adler's resignation from the Psychoanalytic Society, and the minting of a new branch of psychology, the Society for Individual Psychology (Sulloway, 1999).

In more recent times, as psychologists have moved away from psychoanalysis, questions about the link between birth order and personality have remained popular, but the dominant theoretical model is currently derived from evolutionary theory. According to evolutionary models, siblings compete for maximum parental investment (Trivers, 1985) and develop

strategies to increase parental attention by filling different “niches” within the family (Sulloway, 1996). Thus, the firstborn fills the more “traditional” niche, by being a responsible, dominating role-model, who worries about parent-pleasing (i.e., the firstborn should be higher in Conscientiousness, intellectual aspects of Openness, the dominance aspect of Extraversion, and Neuroticism), whereas the laterborn fills the more “rebellious” niche, by being more original, easy going, and sociable (i.e., the laterborn should be higher in the unconventional aspects of Openness, Agreeableness, and the sociability aspect of Extraversion).

In addition to being linked to personality, birth order has also been linked to intelligence, though this theoretical model has a distinct history. The idea that birth order might be related to intelligence started with Sir Francis Galton (1874) who found that firstborn sons were over-represented among prominent English scientists. He attributed this finding to primogeniture practices, whereby 19th century English families invested more resources in firstborn sons (both in terms of attention, nourishment, as well as financial resources and education). He also proposed an explanation based on family environmental influence, whereby firstborns are given more responsibilities than their younger siblings, which might help their intellectual development.

Modern theory has maintained the idea that firstborns might show higher levels of intelligence because of the family environment in which they are raised. Thus, the confluence model (Zajonc & Markus, 1975; Zajonc, 2001) has proposed that the ordinal position of each child in the family determines the level of intellectual stimulation available in early years and thus, their later intelligence. The basic tenet is that the more adults and the fewer children are present in the home, the richer is the overall intellectual environment. Furthermore, with each (younger) child that is added to the family, the overall intellectual environment becomes diluted.

Therefore, the level of intellectual stimulation is purportedly lower for laterborns because the parents have less undivided attention to offer them and the overall intellectual environment of the home is depressed. Though theories based on family environmental influences, such as the confluence model, are by far the most influential, some theories have claimed that the link between birth order and intelligence is explained by prenatal or gestational factors. Specifically, Gualtieri and Hicks (1985) have proposed that maternal antibody levels increase with each subsequent pregnancy which might affect the fetal brain and thus lead to lower intelligence levels among laterborns. We will revisit this issue later, when we present past empirical data.

1.2. Methodological considerations

In studying the links between birth, personality, and intelligence, there are two major methodological issues that have contributed to the continuing debate over inconsistent findings present in the literature. First, is the issue of confounding variables, which, if not properly taken into account can produce biased estimates of the effects. Second, is the issue of design choice, that is, whether a birth order study uses a between- versus a within-family design. We discuss below both of these issues.

1.2.1. Confounds

Previous research and theory (e.g., Sulloway, 1996) suggests that the most important potential confounds in birth order research are sibship size, parental socio-economic status (SES), family structure, age, and gender. If not properly accounted for, these factors may lead to biased estimates of the links between birth order, personality, and intelligence (Ernst & Angst, 1983; Rodgers et al., 2000).

The most recurring “offender” among the above confounds, across research on birth order and personality, as well as research on birth order and intelligence, is sibship size (Ernst &

Angst, 1983; Rodgers et al., 2000). Sibship size represents the total number of siblings present in a family. This is an important confound for research on birth order, because firstborns (vs. lastborns) are more likely to be “found” in low sibships (e.g., the probability of finding a firstborn child from a sibship of two is .50, whereas the probability of finding a firstborn child from a sibship of five is .20). Furthermore, sibship size might influence family dynamics, which might in turn result in distinct patterns of sibling competition and personality development (Dixon et al., 2008). Sibship size may also influence intelligence levels, because, according to the confluence model, families with more children exist in a diluted intellectual environment, which may negatively affect intellectual development (Zajonc, 2001). Additionally, researchers (Page & Grandon, 1979; Rodgers et al., 2000) have proposed that sibship size is related to parental intelligence because parents with higher levels of intelligence tend to have fewer children. This implies that any study that finds higher levels of intelligence among firstborns without controlling for sibship size may simply be showing that intelligence is heritable. Finally, sibship size is also highly correlated to parental SES (i.e., wealthier, more educated parents tend to have fewer children), which brings us to the next confound.

Parental SES is a composite score derived from the level of education, income, and occupational prestige attained by the parents. Parental SES is an important confound in birth order because firstborns tend to come disproportionately from higher SES families, due the lower sibship sizes present in these families (Ernst & Angst, 1983; Rodgers et al., 2000). Furthermore, Previous research has shown that parents of higher SES tend to have higher levels of intelligence and tend to be higher in personality trait levels that might have helped them become successful in the first place (e.g., high conscientiousness, high dominance extraversion) (Shanahan et al., 2014). Thus, higher SES parents may pass on to their children higher levels of intelligence and

certain personality traits through both genetic and environmental mechanisms independent of birth order (Shanahan et al., 2014), but because firstborns are over-represented among higher SES families, in the absence of parental SES controls, it may appear as if firstborns were higher in intelligence, conscientiousness, dominance, and so on due to their birth rank.

Another confound that's been highly debated in the context of birth order and personality research is family structure, which classifies families into families with two parents, parent and step-parent, single parent, adoptive parents, no parents, and so on. Children who are raised in stable homes by two parents should provide a cleaner test of birth order associations, because other types of family structure might introduce various confounds; for example, in blended families, where younger siblings are the genetic offspring of both parents, but older half-siblings are not, the younger siblings are likely to receive higher-quality parental investment and thus be more likely to act as firstborns (Sulloway, 1996).

Age is another possible confound of the associations between birth order and personality, because associations are expected to be larger in childhood and adolescence (Sulloway, 2010). As mentioned earlier, according to Sulloway, birth order effects on personality arise from sibling competition. This competition necessarily happens within the family context and it is likely at its peak during childhood and adolescence when the siblings are most dependent on resources from their parents, and thus must strive to capture their attention and favors through carving their own personality "niche." However, as children grow up and become increasingly independent, it is possible that birth order effects decrease because the roles that were once relevant for survival in the family context in early years may no longer be relevant once the child leaves the family environment (Harris, 2000; 2006).

Finally, some researchers (e.g., Sampson & Hancock, 1967) have argued that gender is another potential confound of the association between birth order and personality, because male and female firstborn children may have different levels of susceptibility to parental influence. Specifically, the researchers argued that firstborn males might be more susceptible to parental influence and to filling the more “traditional” niche by being a responsible, dominating role-model. This increase susceptibility of male firstborns might be due to social norms which have historically imposed a lot of family responsibility on the shoulders of the firstborn son as the one to take over the role of future head of the family in paternalistic societies.

In sum, any serious attempt at establishing the link between birth order, personality, and intelligence should take into account the following background factors: sibship size, parental socio-economic status (SES), family structure, age, and gender.

1.2.2. Between- vs. within-family designs

As mentioned earlier, another major source of controversy in the birth order literature (both with respect to personality and intelligence) is the type of design one chooses to employ (i.e., a between- versus a within-family design).

A between-family study design assesses the personality and intelligence of a cross-section of unrelated people. Additionally, when the participants are individually surveyed, they also report their birth rank (e.g., do they have older siblings or not). Then the researcher compares the scores of first- and laterborns across families, because the participants are not related. In contrast, a within-family design assesses the personality and intelligence of siblings within the same family and then compares the first and laterborn scores of siblings from the same family. Both between- and within-family designs are widely used and they both have advantages and disadvantages, which we detail below.

Between-family designs have been criticized primarily for not being able to adequately control for between-family differences in sibship size, parental socio-economic status (SES), family structure, age, gender, genetic differences, and specific family practices (Paulhus et al., 1999). For the reasons discussed in the previous section, ignoring these sources of variance is likely to produce biased estimates of the birth order effects. The second criticism brought to between-family designs is that they do not reflect the within-family dynamics put forward by the evolutionary niche-finding model, whereby each child is trying to find a niche that has not yet been filled, in order to receive maximum investment from the parents (Sulloway, 1999).

Regarding within-family designs of birth order, some researchers have claimed they are superior to between-family designs because they can adequately control for confounding factors (i.e., researchers assume that if siblings come from the same family, that means they were raised with the same level of parental SES, family structure, etc.) and because they reflect the within-family dynamics put forward by the evolutionary model (Paulhus et al., 1999). However, other researchers have brought strong criticism to this idea for several reasons. First, within-family designs, as they are currently used, tend to introduce a perfect age confound (Wichman, et al., 2006). Specifically, studies so far have tested all siblings at the same time, which means the firstborn was always older than the laterborns at the time of assessment. Given what we know about personality development and maturation (Hogan & Roberts, 2004) it is very possible that the firstborn only appears to be more conscientious, for example, due to being older.¹

The second criticism brought to within-family studies of birth order and personality is that they may suffer from demand effects or social stereotypes that may inflate the correlations (Michalski & Shackelford, 2001). This problem is enhanced, according to Marini and Kurtz (2011), by the fact that the existing within-family research on birth order and personality is

limited by its use of a single rater from each family. Specifically, the single rater compares oneself against one's siblings, thus increasing the likelihood of perceiving a contrast. To our knowledge, there is only one study currently available that used a within-family design (Bleske-Rechek & Kelley, 2014), where each sibling rated their personality independently. The latter study found very small associations with birth order, and these associations were smaller compared to those found in within-family studies that used a single rater, thus supporting the demand effects hypothesis. This demand effect problem does not apply, however, to birth order and intelligence research, where siblings fill in their own intelligence tests.

It becomes apparent that neither between-, nor within-family designs are ideal for studying the effects of birth order. However, there is some potential for improvement. First, the confound issue of between-family designs (Paulhus et al., 1999), may be addressed by using large representative samples, along with statistical controls for parental SES, sibship size, and family structure (Black et al., 2007). Presumably, statistical controls are much more effective and produce more accurate estimates when samples are larger and more representative, because selection biases are minimized, and because control variables (e.g., parental SES) are normally distributed and include the full range of possibilities. Second, between-family designs that include large representative samples and a broad range of control variables may also address some of the issues present in within-family designs. For example, between-family designs would pose no age confound because all the participants could be the same age and measured at the same time and/or age can be a control variable. Furthermore, between-family designs using independent assessments of each participant would also not suffer from demand effects due to social stereotypes (which could occur when one person rates themselves in relation to their sibling). Finally, although Sulloway (1999) has posited that between-family designs may not

represent well enough the within-family dynamics put forward by the evolutionary model, between-family designs do reflect quite accurately the way in which birth order effects have been interpreted and broadcast by both researchers (e.g., Sulloway, 1996) and the popular media (e.g., Leman, 2009). Specifically, birth order researchers (e.g., Sulloway, 1996) have proposed that people's personalities develop a certain way as a result of within-family dynamics (i.e., sibling competition and "niche-finding"). This implies that behavioral patterns resulted from sibling competition are not expected to be transitory and confined to the rearing environment, but they are expected to be internalized and be an important part of people's personality development. In other words, due to behavioral patterns that people need to resort to within the family, personalities may develop in a way that makes, for instance, firstborns more conscientious and lastborns more agreeable. If that is the case, then birth order effects should also appear across families.

1.3. Past empirical research

Early studies of birth order and personality (e.g., Forer, 1977) used between-family designs, small samples, and no control variables for sibship size, parental SES, or family structure. In 1983, Ernst and Angst published a detailed review of the literature dating from 1946 to 1980, concluding that birth order effects on personality had been grossly overestimated due to the use of between-family designs without proper controls for the above confounding factors.

In 1996, Sulloway revived the idea that birth order may influence personality by publishing his seminal book, *Born to Rebel*, where he proposed the evolutionary account for birth order effects, whereby siblings compete for resources and try to fill in distinct family "niches." In this book, the maximum absolute correlations were estimated to be .40 for Openness, .35 for Conscientiousness, .30 for Agreeableness, .20 for Neuroticism, and .10 for

Extraversion (see Sulloway, 1996, p. 473, Note 76). At that time, the author also proposed that within-family studies might produce larger effects than between-family studies, because between-family studies might not be able to properly account for confounding factors even when statistically controlling for these factors, and because between-family designs might not fully reflect within-family dynamics.² A follow-up within-family study conducted on 6,053 individuals found that the absolute correlations were .08 for Openness, .18 for Conscientiousness, .10 for Agreeableness, .04 for Neuroticism, and .14 for Extraversion (Sulloway, 1999).³ Furthermore, between-family studies estimated absolute partial correlations between birth order and personality to be about one-third to one-half of the effect size found in within-family studies (Sulloway, 2007; Sulloway, 2010), which translates as follows: Openness ($r = .04-.06$), Conscientiousness ($r = .06-.09$), Agreeableness ($r = .03-.05$), Neuroticism ($r = .02-.03$), and Extraversion ($r = .04-.07$).

Since then, research on birth order and personality has produced a continuous stream of conflicting results, where some studies found support to the predictions derived from the evolutionarily based family “niche” model (e.g., Saroglou & Fiasse, 2003), whereas others have not (e.g., Michalski & Shackelford, 2001; Marini & Kurtz, 2011).

Research on birth order and intelligence followed a similar pattern to research on birth order and personality, although thanks to larger sample sizes, the findings tend to be more consistent, albeit no less controversial (Zajonc & Sulloway, 2007). The classic study by Belmont and Marolla (1973) was conducted on the entire population of Dutch 19-year-old males and found that intelligence declined steadily from firstborns to lastborns even when controlling for sibship size and parental SES. Although these findings, along with others (e.g., Zajonc, 1976), supported Zajonc’s (2001) “confluence model” of intelligence, these studies have been criticized

for using between-family designs, which were purportedly unable to properly account for confounding factors (Rodgers, 2000; Rodgers, et al., 2000). Researchers (e.g. Rodgers, et al., 2000; Wichman et al., 2006) using within-family designs found no significant relationship between birth order and intelligence. However, more recent studies, conducted on large representative samples of the Norwegian population, found birth order effects on intelligence, with laterborn children showing lower IQs than their early-born counterparts, in both between- and within-family designs (Bjerkedal et al., 2007; Black et al., 2011). Further analyses of the representative Norwegian sample (Kristensen & Bjerkedal, 2007) showed that the likely mechanism behind these effects is the family interaction and stimulation (the confluence model), rather than prenatal gestational factors. The authors brought support for the family interaction model (as opposed to the biological model) by showing that secondborns, who were raised as firstborns because their older sibling had died, had higher levels of intelligence than children who were secondborn biologically and were raised as such because their older sibling had survived.

In sum, over the past two decades, estimates of the effects of birth order on personality have shifted dramatically, in some instances tenfold, studies estimating effects to range from a correlation of .40 to null effects (Sulloway, 1996; Marini & Kurtz, 2011). Some of these changes could be attributed to differences in study design (within- vs. between-family) or confounding factors. However, another possibility is that the use of underpowered study designs is at fault. Large representative samples would be useful for establishing reliable estimates of the effects of birth order on personality, especially in the context of between-family studies, where effects are expected to be smaller. To be precise, an adequately powered between-family study, would need to include a sample of 15,455, to detect an $r=.02$ with 80% power at $p < .05$. In the absence of

such large data sets, the hypotheses put forward by evolutionary models cannot be reliably tested and we are left wondering what effects birth order really has on personality. Regarding the link between birth order and intelligence, the results are much more consistent across different designs, possibly due to the very large representative samples employed (e.g., the Norwegian data included a quarter of a million participants). Furthermore, research on birth order and intelligence consistently supports the family interaction model (e.g., the confluence model).

1.4. Present study

The present study has three major advantages over previous studies: (a) its large representative sample of U.S. high school students, which allows for a confident estimation of effect sizes; (b) the availability of several background measures (age, sex, sibship size, parental SES, and family structure) and the availability of large samples within each background category, which allows for systematic tests of the associations between birth order, personality, and intelligence across different background factors, and (c) its focus on both personality and intelligence in the same sample, which allows for effect size comparisons.

The large sample size renders standard inferential statistics relatively uninformative as almost every effect is statistically significant in the overall sample (e.g., $r = .01$ are statistically significant in the 6-digit sample). Moreover, even a focus on confidence intervals (Cumming, 2013) is not useful because the intervals are so narrow that any effect that differs by the magnitude of .01 on the r metric would be different from any other effect. We therefore describe the effects in terms of whether they are in the direction expected and the magnitude of the correlation or partial correlation for interpretive purposes.

Based on Sulloway (1996; 2001; 2007; 2010), we predicted that firstborns (versus laterborns) should be higher in Conscientiousness, Neuroticism, and the dominance aspect of

Extraversion, whereas laterborns should be higher in Agreeableness and the sociability aspect of Extraversion.⁴ Based on Zajonc's confluence model (2001), we predicted that firstborns (versus laterborns) should score higher on intelligence measures, and that the association should become stronger with increasing distance between birth ranks. The absolute value of the effect size (r) between two neighboring birth ranks is expected to be between .02 and .04 (Zajonc & Sulloway, 2007). Regarding how the associations of birth order and personality traits and intelligence might change across different demographic and family background categories, we did not have clear predictions, because this is the first study to systematically test the birth order associations across different background categories.

2. Methods

2.1. Participants

The data come from Project Talent (see Wise et al., 1979), a longitudinal study that started in 1960 with 5% of America's high-school students. Over 440,000 students in grades 9 through 12 participated, of which 377,016 cases are now available, which make up one of the largest representative samples of students currently available. In the present study, we used data from the original survey to test the roles of birth order and family background on personality and intelligence.

Participants were excluded prior to all analyses based on three factors: (a) low response credibility, (b) twin-, triplet-, or quadruplet-status, and (c) only-child status. The first criterion was meant to guarantee data quality and the latter two are common recommendations in birth order research. Regarding response credibility, we selected only cases that were coded as "credible" on the original Response Credibility Index (Wise et al., 1979).

As a result, the final study sample consisted of 272,003 targets (53.2 % female). The mean age was 15.81 ($SD = 1.26$). Information about race/ethnicity was not collected in the original Project Talent survey. Of the targets, 3% did not provide information on birth order and were therefore excluded from all the analyses. From the remaining 263,712 targets, 36.3% were coded as firstborn, and the others were coded as laterborn. Missing data was handled throughout the analyses using listwise deletion.

Importantly, this participant sample provided us with enough power to detect extremely small effects. For example, in order to detect $r = .01$, with .80 power and an alpha level of .05, one needs a sample size of 61,824, which is much smaller than our total sample size.

2.2. Measures

2.2.1. Birth order

Participants answered two questions relevant to determining birth order: “How many of your brothers, half-brothers, foster-brothers, or stepbrothers are older than you?” and “How many of your sisters, half-sisters, foster sisters, or stepsisters are older than you?” Answer choices for both questions ranged from 0 (“None”) to 11 (“11 or more”). Based on these questions, and following Sulloway (1996), we coded birth order dichotomously. Participants were coded as “firstborn” (dummy code “1”) if they reported having no older brothers or sisters and as “laterborn” (dummy code “0”) if they reported having at least one older sibling. Thus, throughout the paper, positive associations with the birth order variable indicate higher scores for firstborns.

2.2.2. Family background

Previous research emphasized the importance of controlling for sibship size, family structure, and parental SES. Project Talent provides information on all these variables.

Regarding sibship size, participants answered the following question: “What is the total number of living children in your family? Include yourself, together with all full, half-, step-, and foster siblings.” Answer choices ranged from 1 (“One”) to 12 (“Twelve or more”). Descriptive statistics can be found in Table 1. When using sibship size as a control variable in the partial correlations, we used the continuous coding. However, when splitting the data into sibship size categories, we formed three categories: (a) families with 2 to 3 children (this represents half of the population and it is the most commonly used sibship size in birth order research), (b) families with 4 to 5 children (up to the 75th percentile), and (c) families with more than 6 children.

Regarding family structure, participants answered the following question: “With whom are you living; that is, who are the heads of the house?” The answer choices were: “mother and father” (1), “mother only” (2), “father only” (3), “sometimes with my mother, sometimes with my father” (4), “mother and stepfather” (5), “father and stepmother” (6), “grandparents, aunt, uncle, or cousins” (7), “brother or sister” (8), “foster parents (not relatives)” (9), “someone not listed above” (10). Based on previous research (e.g., Marini & Kurtz, 2011), which tends to exclude participants who were not raised by two parents, we recoded this variable into a dichotomous variable, where “mother and father” (1) was re-coded as 1, and all other answer choices (2-10) were re-coded as 0. This is the variable we used as a control in all the partial correlations. For the split family structure analyses, we wanted to provide as few as possible meaningful categories, so we recoded the variable as follows: “two parents” (former code 1), parent and step parent (former codes 5 and 6), single parent (former codes 2, 3, and 4), kinship care (former codes 7 and 8), and foster care (former code 9). The “someone not listed above” category was excluded from the split file because it is not a meaningful category.

Finally, Project Talent provides excellent data on socioeconomic status (SES; Wise et al., 1979). The original SES composite included answers to nine questions regarding home value, family income, number of books in the house, number of appliances, access to media, availability of a private room for the child, father's job status, father's education, and mother's education ($\alpha = .69$). These are all frequently used indicators of SES in the family of origin (Galobardes et al., 2006). The index scores ranged from 59 to 131.

2.2.3. Demographics

In addition to controlling for the above family background factors, previous research has also argued that the target's sex and age might influence birth order associations with personality and intelligence (Sulloway, 1996). Thus, we included these two measures as controls in the analyses. Sex was coded as male = 0, female = 1. For age, we used the grade cohort (9th through 12th) as a proxy, which was coded as a numeric variable ranging from 9 to 12, with a larger number standing for an older cohort. The respective mean ages for each grade cohort were 14 to 17 years old, and there was very little variation in age within each cohort. We chose to use this cohort variable as an age proxy, because of completeness of data (i.e., self-reported age was missing for 10,000 participants). All the results remain virtually the same when replacing age cohort with self-reported age.

2.2.4. Personality

The Project Talent Personality Inventory (PTPI) included 150 items from which ten different scale composites were scored and recorded. The Vigor scale measures the physical activity level of a person. The Calmness scale measures the ability to react to emotional situations in an appropriate manner without extreme emotions. The Mature Personality scale measures the ability to get work done efficiently and to accept assigned responsibility. The

Impulsiveness scale measures the tendency to make quick decisions without full consideration of the outcomes. The Self-Confidence scale measures one's feelings of social acceptability and the willingness to act and think independently. The Culture scale measures the tendency to recognize the value of aesthetic things, and to display refinement and good taste. The Sociability scale measures the tendency to enjoy being with people. The Leadership scale measures activities such as taking charge and seeking out responsibilities. The Social Sensitivity scale measures the propensity to put oneself in another's place. Finally, the Tidiness scale measures the desire for order and neatness in one's environment. For each item, participants rated how well the item described them on a 5-point scale ("extremely well" to "not very well"). Item-level data are unfortunately not available to researchers today for the entire sample (only for 4% of the sample), which is why we relied on the scale scores computed by the Project Talent staff. However, in previous work on independent participant samples of a similar age (Pozzebon et al., 2013), we established the validity and reliability of the 10 PTPI scales, and we identified how the 10 PTPI scales match up to modern Big Five inventories (e.g., John et al., 1991), to make our research more comparable to previous research on birth order and personality (see Table 1).

2.2.5. Intelligence

Project Talent contains a set of scales that represent different content domains of cognitive abilities, including verbal, quantitative, and visualization and spatial abilities. Following past research (e.g., Wai et al., 2009; Damian et al., in press) and the radex model of cognitive ability, which organizes ability in three subdomains—verbal, mathematical, and spatial, we developed composite measures for these three abilities. We used unit weighting in constructing the composites, so no ability scale was over-weighted.

The verbal ability composite ($\alpha = .88$) consists of three scales: Vocabulary, English Composite, and Reading Comprehension. The math ability composite ($\alpha = .93$) consists of four

scales: Mathematics Information, Arithmetic Reasoning, Introductory Mathematics, and Advanced Mathematics. The spatial ability composite ($\alpha = .80$) consists of four scales: Two-Dimensional Spatial Visualization, Three-Dimensional Spatial Visualization, Mechanical Reasoning, and Abstract Reasoning. In addition to the three indices (verbal, math, and spatial), we also computed an overall cognitive ability index which was obtained by averaging the standardized scores of the other three indices.

3. Results

Table 1 contains descriptive statistics and inter-correlations among all the variables of interest. As expected, sibship size correlated negatively with parental SES, which made firstborns overrepresented among low sibship or high SES families. Two-parent households were also characterized by lower sibship sizes and higher SES. Of all the background factors, the largest absolute raw correlations with personality and intelligence were found for parental SES (ranging from .09 to .44), followed by sibship size (ranging from .02 to .25). Raw birth order correlations ranged between .01 and .16 (being a little smaller than the correlations with gender and age), and the smallest correlations were found for family structure (.00 to .12). Although these correlations shed some light over general trends, no conclusions regarding birth order can be drawn because the associations do not yet control for confounding factors.

3.1. Overall birth order associations and the role of background factors

Table 2 presents partial correlations between birth order (first vs. laterborns), personality traits, and intelligence, controlling for age, sex, sibship size, parental SES, and family structure. For the overall data, the partial correlations between birth order and personality ranged from .00 for Vigor (Extraversion) to .04 for Mature Personality (Conscientiousness); the partial

correlations between birth order and intelligence ranged from .00 for spatial ability to .08 for verbal ability, where positive correlations indicate higher scores for the firstborn.

When splitting the data by family structure, sibship size, sex, and age group, the associations between birth order and personality remained virtually unchanged, with the exception of the foster care group (where partial correlations were somewhat larger, ranging from .01 to .07). The associations of birth order with intelligence also remained mostly unchanged across groups, with the exception of the “single parent” group and the “sibship size of 6 or more” group, where the firstborn benefit was reduced in half (e.g., .04 versus .08 for verbal ability).

Overall, our birth order associations are lower than either prior research or predictions would indicate and are not always in the predicted direction. Using only the direction of effect as a criterion, the findings that support the hypothesized birth order associations are that firstborns (versus laterborns) tend to be more conscientious, less sociable, and higher in the dominance aspect of Extraversion (Leadership). The findings that contradict predictions are that firstborns (versus laterborns) tend to be more agreeable and less neurotic. If one uses effect size as a criterion, all of the partial correlations were close to zero, and thus the conclusion would be that birth order has a negligible relation to self-reported personality traits in a between-family design.

Again, using only the direction of the effects as a standard of evaluation, the associations of birth order with intelligence support the confluence model, consistently showing higher intelligence levels for firstborns, with larger partial correlations for verbal ability (as opposed to math or spatial ability). This is in line with the predictions of the model whereby the parental attention advantage that firstborns have mostly consists of verbal stimulation (Zajonc & Sulloway, 2007). However, on an effect size metric, the average partial correlation with

intelligence was .04, indicating a minuscule effect size by almost all standards. The highest partial correlation found, which was .08 is equivalent to about 1.2 IQ points advantage for firstborns.

3.2. Critical subsample: Sibships of three raised by two parents

Past research argued that the strongest and cleanest tests of birth order hypotheses are found when studying families with three children raised by two parents, because we can fully control for sibship size and family background, test the associations of specific birth order ranks, and avoid diluting birth order partial correlations by mixing middle- with lastborns (Healey & Ellis, 2007). The Project Talent study afforded an optimal test of this class of families given the overall size of the sample. Thus, we limited our sample to families of three sibships raised by two parents, and coded first-, middle-, and lastborns as 3, 2, and 1, respectively, to account for contrasts among all birth ranks. We expected larger associations (compared to the overall sample), and we expected that the mean differences in personality traits would be larger between first- and lastborns compared to neighboring birth ranks (because effects should compound with each subsequent birth rank) (Sulloway, 2001). Based on the confluence model of intelligence, we expected firstborns to show higher IQs than middleborns, who would in turn show higher IQs than lastborns.

As Table 3 shows, the means for each birth order rank were sometimes in line with the hypotheses (e.g., firstborns were higher in Conscientiousness than middleborns who were in turn higher than lastborns), and other times against the hypotheses (e.g., firstborns were higher in agreeableness than middleborns who were in turn higher than lastborns). Although the means followed the predicted pattern, that is, the mean differences tended to be larger between first- and lastborns compared to between neighboring birth ranks, we did not find support for the

hypothesis that the birth order effect size would be larger in this subsample. The associations between birth order and personality traits were still very small averaging .03 on an absolute correlational metric. The average association with intelligence was .05. Thus, although the differences between firstborns and lastborns were larger than the differences between firstborns and middleborns, the effect sizes remained minuscule. Regarding the direction of the effects, we replicated the results from the full sample, finding evidence in line with evolutionary models, namely, that firstborns (versus laterborns) tended to be slightly more conscientious, less sociable, and higher in the dominance aspect of Extraversion (Leadership). However, we also found evidence contradicting predictions put forward by the same evolutionary models; thus, firstborns (versus laterborns) also tended to be slightly more agreeable and less neurotic. With regards to intelligence, firstborns again had a slight advantage over laterborns.

3.3. Sensitivity analysis

To test the robustness of our findings regarding birth order and personality, we performed one more analysis. According to Sulloway (1996), birth order associations with personality, especially openness, may be obscured by differences in intelligence. Thus, we conducted partial correlations between each personality trait and birth order, controlling for the intelligence composite, age, sex, and parental SES (see Table 3). We performed these analyses on the reduced sample of targets that were raised in three sibship families by two parents. The association between birth order and personality traits did not show any meaningful changes when controlling for intelligence, although some of the partial correlations did become smaller (e.g., Calmness dropped from .04 to .03).

4. Discussion

We investigated the nature and magnitude of the link between birth order and personality, and between birth order and intelligence. Past research on birth order and personality found contradictory evidence, ranging from null effects to a pattern of differences where firstborns are higher in conscientiousness, neuroticism, and dominance, whereas laterborns are higher in agreeableness and sociability (Sullo way, 1996). Past research on birth order and intelligence generally found a benefit for firstborns (Zajonc, 2001), with decreasing intelligence for each subsequent birth rank.

This article improved upon previous research on birth order in several ways: (a) we used a large representative sample of U.S. high school students where the effect sizes revealed are likely to be very close to the population estimates; (b) we used several relevant demographic and family background factors as controls, and we systematically tested birth order associations within each separate background category; and (c) we examined birth order associations with both personality and intelligence in the same sample.

Setting aside the remarkably small effect sizes, some of the effects we found were in line with predictions put forward by evolutionary models of sibling competition and “niche” forming. Specifically, we found that firstborns (versus laterborns) tended to be slightly more conscientious, less sociable, and higher in the dominance aspect of Extraversion (Leadership). However, we also found evidence contradicting predictions put forward by the same evolutionary models; thus, firstborns (versus laterborns) also tended to be slightly more agreeable and less neurotic. Most importantly, however, the present study helps establish a reliable effect size estimate of the association between birth order and personality across a variety of background factors. To be precise, there were no differences in birth order associations across different background factors, and the average absolute association of birth order with

personality traits was .02. Using this effect size as an indicator, one would conclude that the attention given to the role of birth order on personality is, at best, disproportionate to its importance to the development of personality differences among siblings across families.

Again, setting aside the magnitude of the effect, we found support for the confluence model, which predicted higher intelligence levels for firstborns. Although, again, the effect sizes were quite small, we did find larger partial correlations for verbal ability (as opposed to math or spatial ability), which is in line with the predictions of the model, whereby the parental attention advantage that firstborns have, mostly consists of verbal stimulation (Zajonc & Sulloway, 2007). However, it should be noted that the magnitude of this difference was an almost imperceptible 1 point on an IQ test in the largest case.

As we have highlighted several times, the evaluation of the findings of our study depends largely on how one interprets the meaningfulness of small effect sizes. It is true that when using statistical significance and the direction of effects, some of the predicted relations between birth order and both personality and intelligence are supported in this study. However, the magnitudes of the correlations found are remarkably small. Of course, the importance of the magnitude of an effect is in part driven by what it predicts. If the effect size is small but it is related to something as important, such as cardiovascular disease in the entire population (e.g., Rosenthal, 1990) then a correlation of .02 looms large in its importance. In contrast, birth order is often invoked as an important variable to explain the development of personality and intelligence within and across families. We would have to say that, to the extent that these effect sizes are accurate estimates of the true effect, birth order does not seem to be an important consideration for understanding either the development of personality traits or the development of intelligence in the between-family context. One needs only to look at the “confounds,” such as parental socio-economic

status and gender, for factors that warrant much more attention given the magnitude of their effects relative to the effects of birth order.

Although this paper helps establish the magnitude of associations of birth order with personality and intelligence in a large representative sample of students, and compares effect sizes across several key family background factors, it also has several limitations. First, the Project Talent survey only collected self-reported personality data. Like the present paper, a large portion of birth order research has been conducted using self-reports of personality, and thus our research is highly relevant. Despite the previously estimated associations of birth order with personality being quite small, the associations we found were even smaller. However, given our lack of observer-reports of personality, we cannot speak to those effect sizes. Some previous studies (e.g., Jefferson et al., 1998) reported differences in the strength of association between birth order and personality when using peer- and spouse-ratings, as opposed to self-reports. Specifically, Jefferson and colleagues (1998) found larger effects for peer-ratings. However, more recent studies found no differences between self- and other-reports when looking at the link between birth order and personality (Marini & Kurtz, 2011).

Although a lot of the research on birth order and personality has focused on self- and other- reports of personality, another possibility is to look at actual behaviors that may be more representative of certain personality traits. For example, Sulloway and Zweigenhaft (2010) showed that birth order is differentially related to risk taking behaviors among siblings who play professional baseball. Future studies may try to include more objective behavioral observation measures in addition to self- and other-reports, when investigating birth order associations.

Another potential limitation of our study is that we were unable to control for several possibly important confounds, because data were unavailable. Namely, we could not exclude

targets based on large age gaps between siblings, non-biological sibships, or functional birth order (i.e., the order in which children are raised as opposed to born, as it is often the case in blended families with step-siblings). We were also unable to control for relevant pre- or perinatal factors, such as mother's age. Previous research has suggested that the associations between birth order, personality, and intelligence are associated with each of the above factors (Sullo way, 1999). For example, the link between birth order and intelligence has been found to differ when large age gaps exist between siblings (Bjerkedal et al., 2007). Unfortunately, there is no study to date that accounts for all the possible confounds that have been previously highlighted by independent studies, and that measured both personality and intelligence. However, we would argue that, given (a) our large representative sample of high school students and (b) the low base rates present in the population for several of the control variables that we could not account for, it is unlikely that our effects are merely an artifact. For instance, according to data collected by the US Census Bureau (see Kreider & Lofquist, 2010), 85% of US households include biological children only; thus, it is unlikely that our results were merely due to blended families that included adopted, step-, or half-siblings, because there are relatively few blended families present in the population. Furthermore, even though we were unable to explicitly control for these factors, which might have diluted our effects, we accounted indirectly for non-biological sibships and functional birth order by controlling for family structure.

Finally, it is important to note that our study utilized a between-family design, which according to some researchers is not ideal for studying birth order (e.g., Paulhus et al., 1999; Rodgers et al., 2000). Within-family designs have been proposed as an alternative, but as we highlighted in the introduction, both between- and within-family designs have pros and cons in the context of birth order, and neither of them is the ideal design. Truth be told, the ideal birth

order study has yet to be conducted. We think such a study would look as follows: It would be a longitudinal within-family design study, where each sibling's personality and intelligence was assessed at the same age, using self-reports, parent-reports, peer-reports, and IQ tests. There would be plentiful measures of between-family variation, such as parental SES, parental age, education, family structure, sibship size, age distance between siblings, and type of sibship. Finally, this study would be conducted on a large representative sample of the general population, and the data would be analyzed using multilevel modeling, where within-family effects could be analyzed while taking into account between-family variance. This would be the ideal future direction for birth order research, but until this study is conducted, we consider that both between- and within-family designs are relevant to our current understanding of the link between birth order, personality, and intelligence, because they each provide an important piece of the puzzle, especially when conducted over large representative samples that include key control variables.

5. Conclusion

This study helps establish reliable effect size estimates for birth order on self-report data of personality and on intelligence, taking into account several background factors, in a large representative sample of U.S. high school students. In a between-family design, we found very small associations between birth order and personality, with an average absolute partial correlation of .02. The partial correlations between birth order and cognitive abilities were slightly higher, the average being .04, with a maximum overall association of .08 for verbal ability, where positive associations indicate higher scores for firstborns. In sum, although the direction of some of the effects supported the hypothesized relation between birth order and both personality and intelligence, we would conclude that the magnitude of the effects would indicate that birth order is not an important consideration to either of these outcomes.

References

- Adler, A. (1928). Characteristics of the first, second, and third child. *Children*, 3, 14–52.
- Belmont, L., & Marolla, F. (1973). Birth order, family size, and intelligence. *Science*, 182, 1096-1101.
- Bjerkedal, T., Kristensen, P., Skjeret, G. A., & Brevik, J. I. (2007). Intelligence test scores and birth order among young Norwegian men (conscripts) analyzed within and between families. *Intelligence*, 35(5), 503-514.
- Black, S. E., Devereux, P. J., & Salvanes, K. G. (2011). Older and wiser? Birth order and IQ of young men. *CESifo Economic Studies*, 57, 103-120.
- Bleske-Rechek, A., & Kelley, J. (2014). Birth order and personality: A within-family test using independent self-reports from both firstborn and laterborn siblings. *Personality and Individual Differences*, 56, 15-18.
- Cumming, G. (2013). The new statistics: Why and how. *Psychological Science*.
- Damian, R., Su, R., Shanahan, M., Trautwein, U., & Roberts, B. (in press). Can personality traits and intelligence compensate for background disadvantage? Predicting status attainment in adulthood. *Journal of Personality and Social Psychology*.
- Dixon, M. M., Reyes, C. J., Leppert, M. F., & Pappas, L. M. (2008). Personality and birth order in large families. *Personality and individual differences*, 44(1), 119-128.
- Ernst, C., & Angst, J. (1983). *Birth order: Its influence on personality*. Berlin: Springer.
- Forer, L. (1977). *The birth order factor*. New York: Pocket Books.
- Galobardes, B., Shaw, M., Lawlor, D., Lynch, J., & Smith, G. (2006). Indicators of socioeconomic position. *Journal of epidemiology and community health*, 60, 7-12.
- Galton, F. (1874). *English men of science*. London: MacMillan.
- Gualtieri, T., & Hicks, R. E. (1985). An immunoreactive theory of selective male affliction.

- Behavioral and Brain Sciences*, 8, 427-441.
- Harris, J. R. (2000). Context-specific learning, personality, and birth order. *Current Directions in Psychological Science*, 9, 174–177.
- Harris, J. R. (2006). *No two alike: Human nature and human individuality*. New York: Norton.
- Healey, M., & Ellis, B. (2007). Birth order, conscientiousness, and openness to experience. Tests of family-niche model of personality using a within-family methodology. *Evolution and Human Behavior*, 28, 55–59.
- Hogan, R., & Roberts, B. W. (2004). A socioanalytic model of maturity. *Journal of Career Assessment*, 12, 207-217.
- Jefferson, T., Herbst, J. H., & McCrae, R. R. (1998). Associations between birth order and personality traits: Evidence from self-reports and observer ratings. *Journal of Research in Personality*, 32, 498-509.
- John, O., Donahue, E. M., & Kentle, R. (1991). *The Big Five Inventory*. Berkeley, CA: University of California, Berkeley, Institute of Personality and Social Research.
- Kreider, R. M., & Lofquist, D. A. (2010). Adopted Children and Stepchildren: 2010. *Adoption Quarterly*, 13, 268-291.
- Kristensen, P., & Bjerkedal, T. (2007). Explaining the relation between birth order and intelligence. *Science*, 316(5832), 1717-1717.
- Leman, K. (2009). *The birth order book: Why you are the way you are*. Revell.
- Marini, V., & Kurtz, J. (2011). Birth order differences in normal personality traits: Perspectives from within and outside the family. *Personality and Individual Differences*, 51(8), 910-914.
- Michalski, R., & Shackelford, T. (2001). Methodology, birth order, intelligence, and

- personality. *American Psychologist*, *56*, 520-521.
- Paulhus, D. L., Trapnell, P. D., & Chen, D. (1999). Birth order effects on personality and achievement within families. *Psychological Science*, *10*, 482–488.
- Pozzebon, J., Damian, R. I., Hill, P., Lin, Y., Roberts, B., & Lapham, S. (2013). Establishing the validity and reliability of the Project Talent Personality Inventory. *Frontiers in Psychology—Personality Science and Individual Differences*, *4*, 968.
- Rodgers, J. L. (2000). The Birth Order Trap. *Politics and the Life Sciences*, *19*, 167-170.
- Rodgers, J., Cleveland, H., van den Oord, E., & Rowe, D. (2000). Resolving the debate over birth order, family size, and intelligence. *American Psychologist*, *55*, 599-612.
- Rosenthal, R. (1990). How are we doing in soft psychology. *American Psychologist*, *45*, 775–777.
- Sampson, E. E., & Hancock, F. T. (1967). An examination of the relationship between ordinal position, personality, and conformity: An extension, replication, and partial verification. *Journal of Personality and Social Psychology*, *5*, 398.
- Saroglou, V., & Fiase, L. (2003). Birth order, personality, and religion: A study among young adults from a three-sibling family. *Personality and Individual Differences*, *35*, 19–29.
- Shanahan, M.J. Bauldry, S., Roberts, B.W., Macmillan, R., & Russo, R. (2014). Personality and the reproduction of social class. *Social Forces*, *93*, 209-240.
- Sulloway, F. (1996). *Born to rebel: Birth order family dynamics, and creative lives*. New York: Pantheon Books.
- Sulloway, F. (1999). Birth Order. In M. Runco & S. Pritzker (Eds.). *Encyclopedia of Creativity*, vol. 1 (pp. 189-202). San Diego: Academic Press.
- Sulloway, F. (2001). Birth order, sibling competition, and human behavior. In H. R. Holcomb III

- (Ed.), *Conceptual challenges in evolutionary psychology: Innovative research strategies* (pp. 39-83). Dordrecht and Boston: Kluwer Academic Publishers.
- Sullo way, F. (2007). Birth order. In C. Salmon & T. Shackelford (Eds.), *Evolutionary Family Psychology* (pp.162-182). Oxford and New York: Oxford University Press.
- Sullo way, F. (2010). Why siblings are like Darwin's finches: Birth order, sibling competition, and adaptive divergence within the family. In D. Buss & P. Hawley (Eds.), *The Evolution of Personality and Individual Differences* (pp. 86-119). New York: Oxford University Press.
- Sullo way, F. J., & Zweigenhaft, R. L. (2010). Birth order and risk taking in athletics: A meta-analysis and study of major league baseball. *Personality and Social Psychology Review*, 4, 402-416.
- Trivers, J. (1985). *Social evolution*. Menlo Park, CA: Benjamin/Cummings.
- Wai, J., Lubinski, D., & Benbow, C. (2009). Spatial ability for STEM domains: Aligning over 50 years of cumulative psychological knowledge solidifies its importance. *Journal of Educational Psychology*, 101(4), 817-835.
- Wichman, A. L., Rodgers, J. L., & MacCallum, R. C. (2006). A multilevel approach to the relationship between birth order and intelligence. *Personality and social psychology bulletin*, 32(1), 117-127.
- Wise, L., McLaughlin, D., & Steel, L. (1979). *The Project TALENT Data Bank Handbook, Revised*. Palo Alto, CA: American Institutes for Research.
- Zajonc, R. B. (1976). Family Configuration and Intelligence. *Science*, 192(4236), 227-236.
- Zajonc, R. (2001). The family dynamics of intellectual development. *American Psychologist*, 56, 490-496

Zajonc, R. B., & Markus, G. B. (1975). Birth order and intellectual development. *Psychological review*, 82, 74.

Zajonc, R., & Sulloway, F. (2007). The confluence model: Birth order as a within-family or between-family dynamic? *Personality and Social Psychology Bulletin*, 33(9), 1187-1194.

Footnotes

¹One way to address the age confound in within-family studies would be to track the same family over time and measure each sibling at the same age (e.g., measure the personality of the firstborn when they are 12 and then measure the personality of the laterborn when they are also 12, and compare those two measurements). Unfortunately, we are not aware of any study on birth order and personality that has done this. With respect to birth order and intelligence, the study by Bjerkedal and colleagues (2007) has actually used this improved within-family design, thus eliminating the age confound.

²Notably, other researchers (Michalski & Shackelford, 2001) have made the opposite claim, namely, that within-family studies inflate the effect unjustly due to demand effects (see also previous section).

³The effects reported here are partial correlations controlling for age, sex, sibship size, and social status.

⁴Based on the same research, the predictions for Openness would be that firstborns are higher in the intellectual aspects of Openness, whereas laterborns are higher in the unconventional aspects of Openness. However, in the Project Talent data, the only scale that could be conceived as a proxy for Openness is the Culture scale, which does not capture well either intellectual or unconventional aspects of Openness, thus making predictions based on previous research unfeasible.

Table 1. Inter-correlations among all variables.

No.	Variable	<i>M</i>	<i>SD</i>	<i>N</i>	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	Female	.53	.50	272002	-																		
2	Age cohort	10.46	1.10	272002	-.01	-																	
3	Firstborn	.36	.48	263712	-.02	.08	-																
4	Two parents	.18	.38	269965	-.02	-.00	.06	-															
5	Sibship size	4.04	2.15	272003	.02	-.04	-.23	-.10	-														
6	Parental SES	98.15	10.10	271994	-.03	.07	.14	.15	-.30	-													
7	Sociability (E)	6.77	2.90	271838	.14	.05	.01	.03	-.06	.13	-												
8	Social sensitivity (A)	4.70	2.35	271838	.24	.12	.05	.01	-.07	.17	.50	-											
9	Impulsiveness (-C)	1.96	1.63	271838	.01	.04	.03	-.02	-.02	.09	.22	.20	-										
10	Vigor (E)	3.7	2.13	271838	-.03	.04	.03	.03	-.05	.17	.49	.40	.23	-									
11	Calmness (ES)	4.31	2.51	271838	.05	.14	.06	.03	-.07	.17	.40	.56	.13	.41	-								
12	Tidiness (C)	5.72	2.8	271838	.18	.09	.05	.02	-.07	.13	.39	.52	.09	.38	.51	-							
13	Culture (O)	5.24	2.35	271838	.25	.10	.05	.01	-.06	.18	.43	.61	.18	.40	.51	.58	-						
14	Leadership (E)	1.29	1.36	271838	.03	.05	.03	.00	-.04	.16	.36	.41	.25	.40	.39	.33	.41	-					
15	Self-confidence (ES)	5.15	2.47	271838	-.00	.08	.04	.03	-.05	.15	.36	.27	.11	.31	.42	.26	.29	.31	-				
16	Mature personality (C)	11.25	5.19	271838	.06	.13	.06	.03	-.06	.16	.38	.56	.17	.49	.59	.61	.58	.48	.39	-			
17	Verbal ability	.13	.81	271473	.01	.27	.16	.11	-.25	.44	.04	.19	.06	.13	.20	.12	.16	.10	.16	.23	-		
18	Math ability	.09	.91	272003	-.18	.19	.13	.12	-.20	.41	-.01	.09	.04	.12	.17	.05	.08	.11	.15	.23	.75	-	
19	Spatial ability	.06	.78	267124	-.30	.15	.07	.09	-.16	.33	-.05	.00	.02	.09	.11	-.02	-.02	.03	.10	.10	.59	.63	

Note: Confidence intervals are virtually zero. E, A, C, ES, and O stand for Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness.

Table 2. Partial correlations of personality and intelligence with birth order (a positive partial correlation indicates a higher score for firstborns compared to laterborns)

Personality	Overall ¹	Split by family structure ²					Split by sibship size ³			Split by sex ⁴		Split by age group ⁵			
		Two parents	Parent and stepparent	Single parent	Kinship care	Foster care	Two/three	Four/five	Six or more	Male	Female	9 th grade (14)	10 th grade (15)	11 th grade (16)	12 th grade (17)
Sociability (E)	-.02	-.02	-.02	-.02	.01	.05	-.02	-.02	-.02	-.02	-.02	-.03	-.03	-.02	.00
Social sensitivity (A)	.02	.02	.03	.02	.03	.03	.02	.03	.02	.01	.03	.02	.02	.03	.03
Impulsiveness (-C)	.02	.02	.00	.02	.03	-.01	.01	.03	.02	.01	.02	.02	.02	.02	.02
Vigor (E)	.00	.00	.01	.00	.02	.04	.00	.01	.01	.02	-.01	.01	.00	-.00	.01
Calmness (ES)	.03	.03	.02	.02	.01	.07	.03	.03	.02	.03	.02	.03	.03	.03	.02
Tidiness (C)	.03	.03	.02	.02	.02	.06	.03	.03	.02	.03	.03	.04	.03	.02	.02
Culture (O)	.02	.02	.02	.02	.02	.06	.03	.02	.02	.01	.04	.03	.03	.02	.02
Leadership (E)	.01	.01	-.00	.02	.03	-.02	.00	.01	.02	.01	.01	.01	.00	.01	.01
Self-confidence (ES)	.02	.02	.02	.02	.02	.01	.02	.01	.01	.02	.01	.02	.01	.02	.02
Mature personality (C)	.04	.04	.04	.03	.04	.04	.04	.03	.03	.03	.04	.04	.04	.03	.04
Intelligence															
Verbal ability	.08	.08	.10	.04	.06	.07	.09	.08	.04	.08	.07	.07	.08	.07	.09
Math ability	.05	.05	.07	.02	.03	.03	.05	.05	.03	.05	.05	.03	.05	.04	.06
Spatial ability	.00	.00	.04	-.01	.01	.03	.01	.01	-.02	.02	-.01	-.00	.00	.00	.01
<i>N</i>	257,105	212,207	12,528	24,347	5,242	882	132,685	76,405	48,004	120,662	136,438	65,154	67,306	65,818	58,810

Note: ¹Correlations control for age, sex, sibship size, SES, and family structure. ²Correlations control for age, sex, sibship size, and SES. ³Correlations control for age, sex, SES, and family structure. ⁴Correlations control for age, sibship size, SES, and family structure. ⁵Correlations control for sex, sibship size, SES, and family structure. Confidence intervals range from virtually zero for the 6-digit samples, to .12 for the foster care sample. E, A, C, ES, and O stand for Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness.

Table 3. Means and partial correlations of personality and intelligence with birth order, in sibships of three raised by two parents.

Personality	Firstborn Mean (SD)	Middleborn Mean (SD)	Lastborn Mean (SD)	First/middle/lastborn Partial Correlation	First/middle/lastborn Partial Correlation Controlling for Intelligence
Sociability (E)	6.87 (2.94)	6.98 (2.89)	6.91 (2.86)	-.02	-.01
Social sensitivity (A)	4.89 (2.39)	4.82 (2.35)	4.66 (2.34)	.02	.02
Impulsiveness (-C)	2.01 (1.68)	1.94 (1.62)	1.92 (1.61)	.01	.01
Vigor (E)	3.85 (2.18)	3.85 (2.15)	3.71 (2.14)	.01	.01
Calmness (ES)	4.56 (2.54)	4.44 (2.54)	4.21 (2.5)	.04	.03
Tidiness (C)	5.96 (2.81)	5.88 (2.82)	5.68 (2.8)	.03	.03
Culture (O)	5.44 (2.41)	5.3 (2.36)	5.21 (2.33)	.03	.02
Leadership (E)	1.34 (1.41)	1.34 (1.39)	1.26 (1.34)	.01	.00
Self-confidence (ES)	5.35 (2.54)	5.26 (2.5)	5.08 (2.46)	.03	.02
Mature personality (C)	11.79 (5.34)	11.55 (5.28)	10.92 (5.15)	.05	.04
Intelligence					
Verbal ability	.39 (.76)	.27 (.74)	.15 (.76)	.08	-
Math ability	.34 (.94)	.25 (.90)	.12 (.87)	.05	-
Spatial ability	.21 (.76)	.20 (.74)	.13 (.74)	.01	-
<i>N</i>	22,396	17,373	13,649	52,564	52,563

Note: Positive correlations indicate higher scores for firstborns. All correlations control for age, sex, and SES, and the last column also controls for IQ. Confidence intervals are on average .02. E, A, C, ES, and O stand for Extraversion, Agreeableness, Conscientiousness, Emotional Stability, and Openness.

Highlights

- The average absolute association between birth order and personality was .02
- The average absolute association between birth order and intelligence was .04
- Controls were age, sex, sibship size, socio-economic status, and family structure
- The effects did not differ across different social categories
- The effects did not differ in sibships of three raised by two parents