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Parenting in Childhood Predicts Personality in Early Adulthood: A Longitudinal Twin-Differences Study

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Personality traits such as openness, conscientiousness, and agreeableness predict important life outcomes, and fostering them is therefore a major policy goal. A key modifiable factor that is thought to influence personality is the parenting individuals receive when they are young. However, there is little empirical evidence on the potential impact of parenting on personality traits beyond early adolescence, particularly using causally informative designs. Here, we tested whether mothers' affection toward their children between ages 5 and 10 predicted Big Five personality traits at age 18, when young people leave the structured environment of secondary school and make an important transition to work or further education. We used a prospective longitudinal twin-differences design that compares identical twins growing up in the same family to rule out key confounders and strengthen causal inference. Participants were 2,232 British twins (51.1% female) who had been followed from birth to age 18 as part of the Environmental Risk Longitudinal Twin Study. Twins who had received more affectionate parenting during their childhood years were rated as more open, conscientious, and agreeable young adults by research workers, even when compared with their genetically identical cotwins. There were no differences in extraversion and neuroticism. Associations were small, but they survived stringent robustness checks, including controlling for reporting source, childhood maltreatment, child effects on parenting, and family support at age 18. Our findings suggest that interventions to increase positive parenting in childhood have the potential to make a positive population-wide impact through small but sustained effects on personality traits.

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Environmental Risk (E-Risk) data are free to access by researchers, through a managed access process (https://eriskstudy.com/data-access/). Analysis scripts and measures developed for use in E-Risk are available from Jasmin Wertz upon reasonable request.

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continued

Public Significance Statement
Our study shows that young people who received more affectionate parenting during childhood grew up into more open, conscientious, and agreeable young adults. The study design provides evidence that the effects of maternal affection may be causal and long lasting, suggesting that promoting positive parenting could enhance key character features in young adults to improve outcomes for them and their society.

Keywords: parenting, personality, noncognitive skills, conscientiousness, causal inference

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Personality traits, including openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism, are powerful predictors of important life outcomes, including educational and economic success and health and well-being (Borghans et al., 2008; Jokela et al., 2020; Ozer & Benet-Martínez, 2006; Roberts et al., 2007; Soto, 2019). The predictive power of these traits has attracted significant attention beyond the field of psychology, including from social scientists and policymakers who refer to these traits as "noncognitive" or "socioemotional" skills and consider them a key component of the human capital of individuals and societies (Heckman & Mosso, 2014; Organisation for Economic Co-operation and Development, 2015). In addition to their ability to predict important life outcomes, personality traits are appealing because they are thought to be relatively malleable and influenced by environmental experiences and interventions, particularly compared with other predictors of life outcomes such as cognitive ability (Kautz et al., 2014; Roberts et al., 2017; Shiner et al., 2021). This has raised hope that interventions that can influence personality traits could enhance population health and economic productivity (Kautz et al., 2014; Lundberg, 2017; Organisation for Economic Co-operation and Development, 2015).

A key question for policymakers is which factors interventions should address to influence personality traits. Previous research has pointed to parenting as a promising intervention target, because the parenting individuals receive when they are young has been linked with their personality traits in numerous studies (Ayoub et al., 2021; Emmers et al., 2022; Heckman & Mosso, 2014; Tehrani et al., 2024). However, most of this prior research focuses on personality measured up to early adolescence, with less research, particularly using causally informative designs, on whether parenting predicts personality as young people grow up and enter adulthood. Such research is important for estimating the potential longer term impact of parenting interventions on personality. The transition to adulthood is a particularly significant period because it is a time when young people's personality traits can affect their ability to master important life tasks that form a foundation for their adult lives, such as seeking out work and education opportunities, becoming independent from family, managing time and finances, finding friends and romantic partners, and coping with the stress of entering new settings (McAbee & Oswald, 2013; Nießen et al., 2020; Wagner et al., 2014).

There are at least two contrasting hypotheses about whether the parenting individuals received in childhood predicts their personality beyond early adolescence. The first hypothesis predicts lasting effects of parenting on personality. This hypothesis is based on evidence from intervention studies, which have shown effects of parenting programs on children's personality traits, such as conscientiousness (Emmers et al., 2022; Heckman & Mosso, 2014). Although there are few follow-ups of these programs into adulthood, it has been proposed that the changes induced by these programs at younger ages will persist over time (Heckman & Mosso, 2014; Organisation for Economic Co-operation and Development, 2015). Another source of evidence are observational studies,

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which show correlations between various aspects of parenting and personality traits (Ayoub et al., 2021; Tehrani et al., 2024). However, the interpretation of findings from both sets of studies is complicated by several issues. In intervention studies, a key issue is fade-out, which refers to the common finding that effects of interventions or life events diminish or disappear over time (Abenavoli, 2019; Bailey et al., 2020). Thus, the effects of parenting on personality at younger ages may not last to later ages. In observational studies, a key issue is confounding, for example, by parental personality (Prinzie et al., 2009) or family socioeconomic status (Ayoub et al., 2018; Martin & Donnellan, 2021). Confounding could also arise from genetic influences, if parents' genes are associated with their parenting (Klahr & Burt, 2014; Wertz et al., 2023) and passed on to children and influence personality (Klahr & Burt, 2014; Vukasović & Bratko, 2015), or if children's genetically influenced personality traits evoke differences in parenting (Ayoub et al., 2019; Knafo & Plomin, 2006). In intervention studies, confounding is controlled for by design, but because there are few such studies for personality measured beyond adolescence, it is not clear to what extent associations between parenting and later personality might be confounded by environmental or genetic influences (Briley et al., 2018; Jaffee & Price, 2012).

These issues have given rise to a second hypothesis, which predicts no lasting effects of parenting on personality, particularly within normative ranges of parenting (i.e., absent of extremely adverse parental behaviors). This hypothesis is mostly based on findings from twin studies, which show that siblings' shared environment—which is often interpreted to include parenting—accounts for little if any variability in most traits and behaviors beyond adolescence (Briley & Tucker-Drob, 2014; Polderman et al., 2015). Twin studies also show substantial genetic influences on personality (Vukasović & Bratko, 2015), reinforcing concerns about confounding. However, the interpretation of these findings is complicated by several issues as well. One issue is that few studies have directly tested whether associations between parenting and personality are due to genetic confounding. The other is that shared environmental influences may not capture all the ways in which parenting affects personality. Parenting received by children is also included in the nonshared environment estimated in twin studies, which reflects environments unique to each child in a family and accounts for substantial variability in personality traits throughout development (Briley & Tucker-Drob, 2014). Although it may seem counterintuitive to think of parenting as a child-specific environment, research shows that parents behave differently toward their children—for example, they may parent one child more warmly than its sibling—and that these parenting differences affect children's traits and behaviors (Caspi et al., 2004; Waller et al., 2018).

A research approach that addresses many of the issues complicating previous research is to study genetically identical (monozygotic [MZ]) twins who grew up in the same family but differ in the parenting they experienced. This design is powerful because MZ twins are perfectly matched on shared environmental and genetic background, ruling out these sources of confounding, which are key threats to causal inference. Here, we used this design to test associations between parenting and personality in a U.K.-based cohort of twins followed from birth to age 18. Parenting was prospectively measured for each twin at ages 5 and 10. We focused on parental expressions of affection because a wealth of prior research reports associations between affectionate parenting and offspring outcomes, including personality (Lianos, 2015; Tehrani et al., 2024; Zhou et al., 2023). Previous research has shown that identical twins in this cohort experience differences in maternal affection (Caspi et al., 2004), consistent with findings in other cohorts (Henry et al., 2018; Waller et al., 2018). Our study tested whether differences in maternal affection toward each twin predicted twins' personality at the cusp of adulthood, at age 18. To measure personality, we focused on the "Big Five" personality traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism (Digman, 1990; McCrae & Costa, 2008). Big Five traits were measured using multiple informants (nonfamily and family members) to reduce concerns about shared method variance and informant biases (Ganiban et al., 2008; McCrae, 2018; Saudino et al., 2000).

We first analyzed associations between parenting and personality across the entire sample, for comparison to prior findings in nontwin samples. We then analyzed this association within twin pairs, separately for nonidentical (dizygotic [DZ]) twins (to control for shared environmental influences) and identical (MZ) twins (to additionally control for all genetic influences). Associations remaining within identical twins were subjected to a series of robustness tests.

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First, we tested whether associations remained across multiple informants of personality. Second, we tested whether parenting only matters when it is extremely adverse, as has been proposed in previous debates of parental influence (Scarr, 1992), by analyzing twins' maltreatment history. Third, we tested whether associations were better explained by "child effects" from child to parent, rather than parenting affecting twins (Ayoub et al., 2018), by adjusting for twins' behavioral and emotional problems at age 5. Fourth, we tested whether associations reflected lasting effects of childhood parenting, rather than the continuity in parenting over the years, by adjusting for received parenting at age 18.

Method

Participants

Participants were members of the Environmental Risk (E-Risk) Longitudinal Twin Study, which tracks the development of a 1994–1995 birth cohort of 2,232 British children (Moffitt & E-Risk Study Team, 2002). Briefly, the E-Risk sample was constructed in 1999–2000, when 1,116 families (93% of those eligible) with same-sex 5-year-old twins participated in home-visit assessments. This sample comprised 56% MZ and 44% DZ twin pairs (49% male; 90% White British). The study sample represents the full range of socioeconomic conditions in Great Britain, as reflected in the families' distribution on a neighborhood-level socioeconomic index (A Classification of Residential Neighborhoods, developed by CACI, Inc., for commercial use; Odgers, Caspi, Bates, et al., 2012; Odgers, Caspi, Russell, et al., 2012): 25.6% of E-Risk families live in "wealthy achiever" neighborhoods, compared with 25.3% nationwide, 5.3% compared with 11.6% in "urban prosperity" neighborhoods, 29.6% compared with 26.9% in "comfortably off" neighborhoods, 13.4% compared with 13.9% in "moderate means" neighborhoods, and 26.1% compared with 20.7% in "hard-pressed" neighborhoods. Urban prosperity families are underrepresented in E-Risk because such households are often childless.

Follow-up home visits were conducted when the children were aged 7 (98% participation), 10 (96%), 12 (96%), and 18 (93%). At age 18, a total of 2,066 participants were assessed, each twin by a different interviewer. There were no differences between those who did and did not take part at age 18 in terms of socioeconomic status assessed when the cohort was initially defined ($\chi^2 = 0.86$, $p = .65$), age 5 IQ scores ($t = 0.98$, $p = .33$), and age 5 behavioral or emotional problems ($t = 0.40$, $p = .69$ and $t = 0.41$, $p = .68$, respectively). The Joint South London and Maudsley and the Institute of Psychiatry Research Ethics Committee approved each phase of the study. Parents gave informed consent, and twins gave assent between 5 and 12 years and then informed consent at age 18.

Measuring Maternal Affectionate Parenting

Maternal affection toward each child was measured using mothers' expressed emotion about each of her children, using procedures adapted from the Five-Minute Speech Sample method (Magaña et al., 1986) as previously described (Caspi et al., 2004). Trained interviewers asked mothers to describe each of their children ("For the next 5 minutes, I would like you to describe [child] to me; what is [child] like?"). The mother was encouraged to talk freely with few interruptions. If the mother found this difficult, the interviewer could aid the mother with a series of semistructured probes, such as "In what ways would you like [child] to be different?" Two measures were coded from these samples. Maternal *warmth* was assessed by the tone of voice, spontaneity, sympathy, and/or empathy toward the child. Warmth was coded on a 6-point scale, where higher values indicate definite and clear-cut tonal warmth, enthusiasm, and interest in and enjoyment of the child (e.g., "She is a delight, she is so happy, I love taking her out, she is my ray of sunshine"). *Dissatisfaction* refers to the negativism expressed in the interview about the child. On a 6-point scale, higher values indicate that the mother had very little good to say about her child or gave the impression that she actively disliked the child (e.g., "I wish I had never had her … she's a cow, I hate her"). Coding was done by two trained raters blind to all other E-Risk Study data. Interrater reliability was established by having raters individually code audiotapes describing 40 children and was $r = .90$ for warmth and $r = .84$ for dissatisfaction. Previous research and our own analyses support the validity of maternal expressed emotion measures as a proxy for observed parenting behaviors (Weston et al., 2017; Supplemental Method). Warmth and dissatisfaction were negatively correlated with each other ($r = -.59$ at age 5; $r = -.50$ at age 10),

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suggesting that they represent related, but not identical, aspects of maternal affection. They were also positively correlated within themselves across ages ($r = .37$ for warmth; $r = .32$ for dissatisfaction). Following previous research (Wertz et al., 2023) and as preregistered in our analysis plan, we constructed a measure of maternal affection across childhood by averaging across the (standardized) measures of warmth and (reverse-coded) dissatisfaction at ages 5 and 10 and then across ages 5 and 10. We did this to obtain a measure of maternal affection that was comprehensive and relevant to parenting interventions (which often target or affect broad parenting behaviors or styles) and to increase parsimony and reduce redundancy in our analyses. However, we also report results for each age (Supplemental Figure S1) and for warmth and dissatisfaction separately (Supplemental Figure S2).

Measuring Personality

Participants' personalities were measured through reports by study interviewers after the age-18 study visit, using a 27-item adjective scale capturing Big Five personality traits including openness to experience (e.g., curious, imaginative, perceptive), conscientiousness (e.g., focused, diligent, planful), extraversion (e.g., talkative, gregarious, cheerful), agreeableness (e.g., considerate, rude [reverse-coded], spiteful [reverse coded]), and neuroticism (e.g., fearful, touchy, tense; Digman & Shmelyov, 1996). Interviewers were asked: "Based on your interaction with the twin do you think he/she is …," rating each adjective on a 3-point scale. One interviewer rated each twin. Interviewers were blind to information from previous study waves. Cronbach's αs were .67 for openness, .79 for conscientiousness, .82 for extraversion, .66 for agreeableness, and .55 for neuroticism. Each scale was z standardized to $M = 0$, $SD = 1$.

We used interviewer reports instead of family member reports of participants' personality in our main analyses to reduce bias from shared method variance (which would arise if mothers reported both their parenting and twin's personality). However, we conducted sensitivity analyses using family member reports of participants' personality (mostly mothers and cotwins). As previously described (Richmond-Rakerd et al., 2019; Wertz et al., 2021), reports were made on a brief, 25-item version of the Big Five Inventory (Benet-Martínez & John, 1998) capturing openness to experience (e.g., "Original, comes up with new ideas"), conscientiousness (e.g., "Works until a thing is done"), extraversion (e.g., "Outgoing, likes people"), agreeableness (e.g., "Kind and considerate"), and neuroticism (e.g., "Gets nervous easily"). Cronbach's αs for mothers' and cotwins' reports, respectively, were .81 and .78 for openness, .79 and .76 for conscientiousness, .68 and .68 for extraversion, .66 and .65 for agreeableness, and .74 and .65 for neuroticism. Correlations between twin and parent coinformants were .41 for openness, .50 for conscientiousness, .49 for extraversion, .39 for agreeableness, and .43 for neuroticism. 99.3% of participants had data from at least one coinformant. 83% had data from two coinformants. Each scale was z standardized and averaged across coinformants and then restandardized. Correlations between interviewer and coinformants were .23 for openness, .29 for conscientiousness, .37 for extraversion, .31 for agreeableness, and .24 for neuroticism; this is close to meta-analytic estimates of correlations between self-report and other reports of personality (Connolly et al., 2007) and supports the validity of our interviewer reports.

Measuring Covariates

Maltreatment

Exposure to maltreatment (physical or sexual) was measured at ages 5, 7, 10, and 12, using reports by mothers, as previously described (Jaffee et al., 2004, 2007), using a standardized clinical interview protocol (Dodge et al., 1990; Lansford et al., 2002). Over the years of data collection, the study developed a cumulative profile for each child, comprising caregiver reports, recorded debriefings with interviewers, recorded narratives of the successive caregiver interviews, and information from clinicians whenever the study team made a child-protection referral. The profiles were reviewed at the end of the age 12 phase by two clinical psychologists. Initial interrater agreement between the coders exceeded 90%, and discrepantly coded cases were resolved by consensus review. Profiles were coded as 0 = no maltreatment at any age (78.9% of the cohort), 1 = probable maltreatment at any age (15.4%), and 2 = definite maltreatment at any age (5.7%). For analyses using a binary measure, we collapsed across the "probably" and "definite"

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categories to capture every child for whom there had been evidence of maltreatment.

Childhood Behavioral and Emotional Problems

E-Risk participants' behavioral and emotional problems at age 5 were measured using the Child Behavior Checklist for mothers (Achenbach, 1991a) and the Teacher's Report Form (Achenbach, 1991b) as previously described (Caspi et al., 2004). The Behavioral Problems Scale includes items such as "gets in many fights," "lying or cheating," and "screams a lot." Cronbach's αs were .88 (mothers) and .93 (teachers). The Emotional Problems Scale includes items such as "cries a lot," "withdrawn," and "worries." Cronbach's αs were .84 (mothers) and .85 (teachers). Consistent with prior research reports from both informants were modestly correlated ($r = .30$ for behavioral problems; $r = .20$ for emotional problems) and were combined to obtain reliable and comprehensive measures (Achenbach et al., 2005).

Family Support in Early Adulthood

E-Risk participants' experience of support from their family was measured at age 18 using participants' self-reports on the family support subscale of the Multidimensional Scale of Perceived Social Support (Zimet et al., 1990; example items: "I can talk about my problems with my family"; "I get the emotional support and help I need from my family"). Participants rated the four items as 0 (*not true*), 1 (*somewhat true*), or 2 (*very true*). Cronbach's α was .90.

Statistical Analysis

To test associations between affectionate parenting and personality across the entire sample (i.e., not within twins), we used linear regression models, adjusted for sex and the nonindependence of observations within families. To test associations between twin differences in affectionate parenting and twin differences in each personality trait, we used fixed-effects regression models, first for all twin pairs and then separately for DZ twins (to control for shared environmental influences) and MZ twins (to additionally control for all genetic influences). Although our study focuses on MZ twins, we present the baseline associations for parenting and personality for all twins combined and for DZ twins for completeness. A prerequisite for these analyses is that twins differ in affectionate parenting and personality. We tested this by analyzing correlations between twins and cotwins in parenting and personality (Supplemental Table S1). As expected, twins within a pair resembled each other in affectionate parenting and personality; resemblance was greater for MZ than DZ twins, consistent with genetic influences. However, even MZ twins differed in parenting and personality; the highest twin-pair correlation was $r = .53$ (for parenting).

For any associations remaining between affectionate parenting and personality within MZ twins, we conducted sensitivity analyses to test their robustness. These analyses used the same baseline fixed-effects regression models but varied the predictor or outcome or added a confounder. Specifically, to test whether associations persisted when using different informants, we used coinformant ratings of personality as the outcome. To test whether any effects of parenting were accounted for by "extreme" variation in parenting, we controlled for and then excluded twins from families with evidence of maltreatment. To test whether the effects were due to child effects on parenting, we controlled for twins' behavioral and emotional problems at age 5. To test whether the effects were due to the continuity of supportive parenting into early adulthood, we controlled for family support at age 18.

Our analyses included participants with valid data for parenting for at least 1 age and for at least one personality trait at age 18. The exact *n* is reported in each table/figure. Analyses were done using Stata Version 17.0 (StataCorp, 2021).

Transparency and Openness

The premise, methods, and analysis plan for this project were preregistered at https://sites.duke.edu/moffittcaspiprojects/files/2021/07/Wertz_2021a.pdf (February 23, 2021). There were two deviations from the preregistration as outlined in Supplemental Table S2. First, we used measures of childhood behavioral and emotional problems instead of childhood temperament to control for child effects on parenting; this was done because childhood temperament was not associated with differences in parenting within MZ twins as had been expected (Supplemental Table S3), so we sought to use a stronger control variable to increase the robustness of our findings. Using these measures is likely to capture more variation associated with differences in parenting behavior

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than measures of children's temperament and is therefore a more conservative strategy. The original preregistered analyses are reported in Supplemental Figure S3. Second, we conducted exploratory analyses of whether associations between parenting and personality persisted after controlling for family support at age 18, to explore whether any of our associations could be explained by the continuity of supportive parenting. Analyses reported here were checked for reproducibility by an independent data analyst, who recreated the code by working from the article and applied it to a fresh data set. Regarding the availability of materials, code, and data, the Child Behavior Checklist and personality reports are protected by copyright. Analysis scripts and measures developed for use in E-Risk are available upon request to the corresponding author. E-Risk data are free to access by researchers, through a managed access process (https://eriskstudy.com/data-access/).

Results

Does Parenting Predict Personality in the Full Cohort?

We first tested associations between affectionate parenting in childhood and personality in early adulthood in the full cohort. This analysis treats every study member as an individual rather than as a member of a twin pair. It asks: do participants who received more or less affectionate parenting in childhood relative to other participants show differences in their personality in early adulthood? Participants who had received more affectionate parenting as children were rated as more open to experiences ($\beta = .23$, 95% CI [.18, .27], $p < .01$), conscientious ($\beta = .26$, 95% CI [.22, .31], $p < .01$), extraverted ($\beta = .12$, 95% CI [.07, .16], $p < .01$), agreeable ($\beta = .18$, 95% CI [.14, .23], $p < .01$), and less neurotic ($\beta = -.08$, 95% CI [−.13, −.03], $p < .01$) young adults by study interviewers (Table 1 and Supplemental Figure S4).

Does Parenting Predict Personality Traits Within MZ and DZ Twin Pairs?

We next tested associations between affectionate parenting and personality within MZ and DZ twin pairs. This analysis treats every study member as a member of a twin pair. It asks: do twins who received more or less affectionate parenting *relative to their cotwin* show differences in their personality in early adulthood? Because these analyses successively control for more familial influences, associations evident in the full cohort would be expected to reduce within DZ twins (i.e., when controlling for all of twins' shared family environment and 50% of shared genes) and reduce even further within MZ twins (i.e., when additionally controlling for all of twins' shared genes). Our results mostly conformed to this pattern. Twins who had received more affectionate parenting relative to their cotwin were rated as more open, conscientious, and agreeable young adults (Figure 1 and Table 1).

Table 1
Associations Between Affectionate Parenting in Childhood and Personality Traits in Early Adulthood Across the Full Sample and Within Twins

	Across full sample	Within MZ and DZ twin	Within DZ twin	Within MZ twin
Outcome	Est. [95% CI]	Est. [95% CI]	Est. [95% CI]	Est. [95% CI]
Openness	.23 [.18, .27]	.15 [.08, .22]	.20 [.08, .31]	.10 [.01, .19]
Conscientiousness	.26 [.22, .31]	.15 [.08, .22]	.17 [.05, .28]	.13 [.04, .22]
Extraversion	.12 [.07, .16]	.09 [.02, .16]	.11 [.00, .23]	.06 [−.02, .14]
Agreeableness	.18 [.14, .23]	.11 [.04, .19]	.10 [−.01, .21]	.13 [.03, .23]
Neuroticism	−.08 [−.13, −.03]	−.06 [−.15, .01]	−.11 [−.22, .01]	−.03 [−.12, .08]

Note. Associations between parenting and personality traits at age 18, as rated by study interviewers. The "across full sample" column reports estimates for the entire sample (i.e., treating each individual as the unit of analysis). The n varied from $n = 2{,}051$ to $n = 2{,}055$. Analyses are adjusted for sex and clustering of individuals within families. The "within MZ and DZ twin" column reports the estimate within twins (i.e., treating each twin pair as the unit of analysis), for both MZ and DZ twins. The n of complete twin pairs varied from $n = 1{,}012$ to $n = 1{,}016$ depending on personality trait. The "within DZ twin" and "within MZ twin" columns report the estimates within DZ and MZ twins, respectively. The n of complete DZ twin pairs ranged from $n = 439$ to $n = 441$, and n of complete MZ twin pairs ranged from $n = 573$ to $n = 575$. All analyses are based on z-transformed variables. The affectionate parenting measure is the average across ages 5 and 10. Error bars indicate 95% CIs. MZ = monozygotic; DZ = dizygotic; Est. = estimate; CI = confidence interval.

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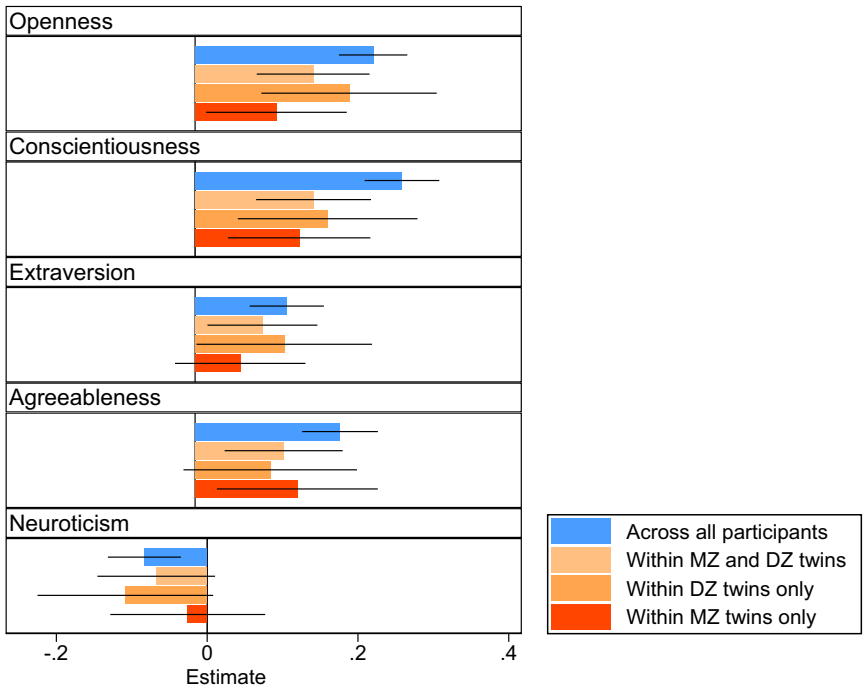
Although estimates were reduced compared with those in the full cohort, they remained significant in both DZ twin pairs and MZ twin pairs, indicating that affectionate parenting predicted these personality traits net of shared environmental and genetic influences (Figure 1 and Table 1). For extraversion and neuroticism, associations were no longer statistically significant within DZ and MZ twin pairs, suggesting that shared environmental and genetic influences explain why childhood parenting predicted these traits in the full cohort. In the following, we restricted all our analyses to MZ twin pairs to further interrogate associations between parenting and personality after controlling for shared environmental and genetic influences.

Are Associations in MZ Twins Evident Across Family Versus Nonfamily Informants?

We reran our models using reports from informants who knew the twins well (mostly mothers and cotwins; Figure 2

Figure 1
Associations Between Parenting and Personality in the Full Cohort and Within Twins



Note. Estimates of associations between affectionate parenting in childhood (across ages 5 and 10) and personality traits at age 18, as rated by study interviewers. In each panel, the first bar from the top shows estimates for the entire sample (i.e., treating each individual as the unit of analysis). The *n* varied from $n = 2{,}051$ to $n = 2{,}055$. Analyses are adjusted for sex and clustering of individuals within families. The second bar reports the estimate within twins (i.e., treating each twin pair as the unit of analysis), for both MZ and DZ twins combined. The *n* of complete twin pairs varied from $n = 1{,}012$ to $n = 1{,}016$ depending on personality trait. The third and fourth bars report the estimates within DZ and MZ twins, respectively. The *n* of complete DZ twin pairs ranged from $n = 439$ to $n = 441$, and the *n* of complete MZ twin pairs ranged from $n = 573$ to $n = 575$. All estimates are based on *z*-transformed variables. Error bars indicate 95% confidence intervals. MZ = monozygotic; DZ = dizygotic. See the online article for the color version of this figure.

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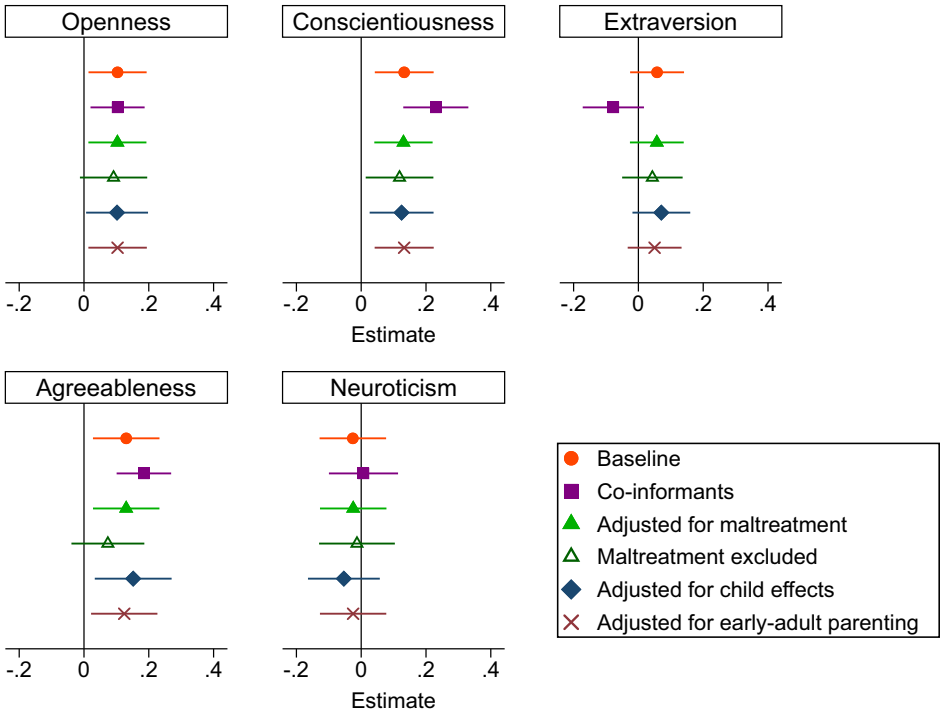
and Table 2). As would be expected, some estimates were larger in these analyses (particularly associations with conscientiousness and agreeableness). However, the overall pattern of results remained similar: MZ twins who had received more affectionate parenting in childhood relative to their genetically identical cotwins were rated as more open, conscientious, and agreeable as young adults, but they did not differ significantly in extraversion and neuroticism (Figure 2 and Table 2).

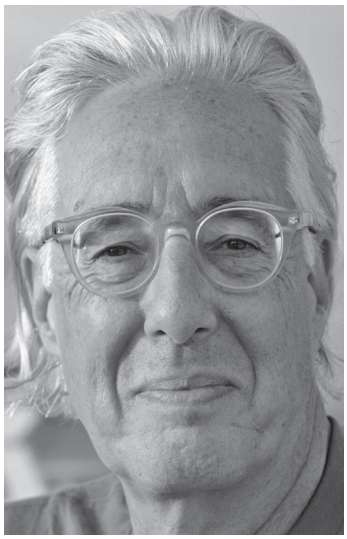
Are Associations in MZ Twins Accounted for by Extremely Adverse Parenting?

In discussions about the influence of parenting, it has been argued that parenting may only matter when it is extremely adverse and that parenting within the normal, expected range may not matter (Scarr, 1992). We tested this by accounting for adverse parenting, operationalized as maltreatment.

Figure 2
Within-Monozygotic-Twin Pair Sensitivity Tests of Associations Between Parenting and Personality



Note. The ways in which associations between affectionate parenting in childhood and personality traits in early adulthood are affected by changes to the "baseline" model, which shows associations between parenting and personality as rated by study interviewers, within MZ twins. The "coinformants" model uses personality as reported by coinformants (mostly mothers and cotwins). The "adjusted for maltreatment" model controls for exposure to maltreatment up to age 12. The "maltreatment excluded" model excludes the $n = 147$ families (including both twins) with evidence of maltreatment. The "adjusted for child effects" model controls for children's behavioral and emotional problems at age 5. The "adjusted for early-adult parenting" model controls for family support at age 18. The n of monozygotic twin pairs ranged from $n = 573$ to $n = 575$. All estimates are based on z-scored variables. Error bars indicate 95% confidence intervals. Table 2 reports the estimates for each model. MZ = monozygotic. See the online article for the color version of this figure.



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We first tested whether maltreatment predicted personality (Supplemental Table S4). Maltreatment predicted lower openness, conscientiousness, and agreeableness, higher neuroticism in the full cohort, and lower conscientiousness within MZ twins. We then statistically controlled for twin differences in exposure to maltreatment in childhood, up to age 12. This did not change the pattern of results (Figure 2 and Table 2). We also excluded from our analyses those $n = 147$ families (including both twins) for whom there had been evidence of maltreatment. Point estimates remained similar for openness and conscientiousness (though the estimate for openness became statistically nonsignificant). For agreeableness, the effect reduced by half and became nonsignificant (Figure 2 and Table 2).

Are Associations in MZ Twins due to Child Effects on Parents?

We tested the possibility of reverse causality, whereby mothers may adjust their parenting in response to their children, rather than parenting affecting offspring personality, by analyzing maternal reports of childhood behavioral and emotional problems at age 5. Consistent with child effects, more behavioral and emotional problems were associated with less affectionate parenting in the full cohort and within MZ twins (Supplemental Table S4). However, controlling for twin differences in behavioral and emotional problems at age 5 did not change the pattern of our main results (Figure 2 and Table 2).

Are Associations in MZ Twins due to Family Support at Age 18?

At age 18 most young people are still in relatively close contact with their parents. To test whether the associations we observe may reflect the continuity of parenting from childhood to adulthood, rather than a lasting effect of parenting in childhood, we controlled for family support at age 18. Family support in adulthood was predicted by affectionate parenting in childhood and associated with each adult personality trait in the full sample and with greater extraversion and agreeableness within MZ twins (Supplemental Table S4). However, statistically controlling for twin differences in family support at age 18 did not change our pattern of results (Figure 2 and Table 2).

Discussion

Using an identical-twin differences design that strictly controls for shared environmental and genetic confounding,

Table 2
Within-MZ-Twin Pair Sensitivity Tests of Associations Between Parenting in Childhood and Personality Traits in Early Adulthood

	Baseline within MZ twin	Coinformant	Adjusted for maltreatment	Maltreatment excluded	Adjusted for child effect	Adjusted for early-adult parenting
Outcome	Est. [95% CI]	Est. [95% CI]	Est. [95% CI]	Est. [95% CI]	Est. [95% CI]	Est. [95% CI]
Openness	.10 [.01, .19]	.10 [.02, .19]	.10 [.01, .19]	.09 [−.01, .20]	.10 [.01, .20]	.10 [.01, .19]
Conscientiousness	.13 [.04, .22]	.23 [.13, .33]	.13 [.04, .22]	.12 [.01, .23]	.12 [.03, .22]	.13 [.04, .22]
Extraversion	.06 [−.02, .14]	−.08 [−.17, .01]	.06 [−.03, .14]	.04 [−.05, .14]	.07 [−.02, .16]	.05 [−.03, .13]
Agreeableness	.13 [.03, .23]	.18 [10, .27]	.13 [.03, .23]	.07 [−.04, .19]	.15 [.03, .27]	.12 [.02, .23]
Neuroticism	−.03 [−.12, .08]	.01 [−.10, .11]	−.02 [−.13, .08]	−.01 [−.13, .10]	−.05 [−.16, .06]	−.02 [−.13, .08]

Note. Associations between parenting and personality traits and how these are affected by changes to the baseline model. The "baseline model" reports associations between childhood parenting and Big Five personality traits, as reported by study interviewers, within MZ twins. The "coinformants" model reports associations between childhood parenting and Big Five traits as reported by coinformants (mostly mothers and cotwins). The "adjusted for maltreatment" model is the same as the baseline model, but it controls for exposure to physical and sexual maltreatment by an adult up to age 12. The "maltreatment excluded" model is the same as the baseline model, but it excludes the $n = 147$ families (including both twins) for whom there had been evidence of maltreatment in childhood. The "adjusted for child effects" model is the same as the baseline model, but it controls for children's behavioral and emotional problems assessed at age 5. The "adjusted for early-adult parenting" model is the same as the baseline model, but it controls for family support at age 18. All estimates are based on z-scored variables. The affectionate parenting measure is the average across ages 5 and 10. Error bars indicate 95% CIs. MZ = monozygotic; Est. = estimate; CI = confidence intervals.

our findings provide support for the hypothesis that parenting in childhood has effects on some personality traits into early adulthood. In particular, children who received more affectionate parenting by their mothers up to age 10 were more open to experiences, conscientious, and agreeable at age 18. These effects were evident across family and nonfamily informants, and they mostly remained after accounting for a variety of alternative explanations. This finding is consistent with previous research of the impact of parenting interventions on conscientiousness in children (Emmers et al., 2022; Heckman & Mosso, 2014), and it extends this prior work by suggesting that the effects of parenting may last into early adulthood and expand to openness and agreeableness. These two traits have received less attention in previous intervention studies, but they are highly relevant for research and policy given their prediction of educational, employment, and health outcomes (Kuncel et al., 2010; Malanchini et al., 2019; Ozer & Benet-Martínez, 2006).

Affectionate parenting was associated with extraversion and neuroticism in the full cohort (i.e., across all participants), with estimates close to those reported in a recent meta-analysis of associations between parenting and these traits (Tehrani et al., 2024). However, these associations reduced and became nonsignificant within twins, particularly within identical twins. This finding suggests that previous findings of associations between affectionate parenting and these traits may have been due to influences shared between siblings, particularly genetic influences. For neuroticism, this finding appears to contrast with prior research reporting that cognate phenotypes, such as internalizing problems in childhood, are responsive to intervention-induced changes in parenting (Costantini et al., 2023; Yap et al., 2016). However, prior evidence on longer term effects of parenting interventions is more mixed (Costantini et al., 2023), and few previous studies have followed participants into adulthood, making it difficult to compare these and our findings. Both neuroticism and extraversion have also been shown to respond to therapeutic interventions in adulthood (Roberts et al., 2017). Thus, even if parenting as an environmental influence may not have lasting effects on these traits, other environmental inputs may be effective in changing this trait in adulthood.

Our findings need to be interpreted in light of limitations. First, the identical-twin differences design focuses only on factors that differ between twins, which magnifies the impact of measurement error and reduces the precision of estimates (Boardman & Fletcher, 2015). Furthermore, there may be unmeasured confounders at the individual-twin level that could account for the associations we observe, including differences between twins that evoke differences in parenting beyond the ones we controlled for. However, this design is one of only a few observational approaches that control for genetic and shared environmental influences, which are key threats to causal inference (Moffitt, 2005; Pingault et al., 2018). Second, neuroticism had relatively low reliability when measured using interviewers' reports. However, we observed similar findings when using coinformant reports that had higher reliabilities. Third, our measure of parenting focused on only one aspect of parenting (affection) and only one parent (mothers). Other aspects of parenting had not been assessed individually for each twin, and by both parents, across childhood in the E-Risk study. However, affectionate parenting by mothers is a relevant measure because it is targeted in many parenting interventions (Costantini et al., 2023; Morawska et al., 2019). Fourth, effect sizes were small. However, they must be interpreted in context—analyses controlled for shared method variance, shared environmental and genetic confounding, and, in sensitivity analyses, extreme variations in parenting, child effects, and family support in early adulthood. Furthermore, even small effect sizes can translate into considerable population-wide impact (Funder & Ozer, 2019), particularly for personality traits such as conscientiousness, that consistently and strongly predict important life outcomes (Kautz et al., 2014; Roberts et al., 2017).

Our findings have implications for psychological theory and research. The observation that twin differences in personality were predicted by differences in parenting goes against a "gloomy prospect," sometimes expressed in debates about environmental influences on behavioral outcomes, that nonshared environmental influences are entirely random and intractable (Plomin & Daniels, 2011; Turkheimer & Waldron, 2000). It also adds to a growing body of research identifying specific environmental factors that contribute to differences between twins in outcomes such as mental health and school performance (von Stumm & Plomin, 2018; Waller et al., 2018). However, what these and our findings also show is that specific environmental factors account for small portions of differences within identical twins. In this way, nonshared environmental influences may behave similarly to genetic influences in that individual genetic variants account for only small percentages of variation, even if on the whole genetic influences are large for most traits. The possibility that nonshared environmental influences behave in a similar manner may help set realistic expectations when seeking to discover and modify environmental influences on behaviors.

Our findings have implications for policy and interventions. The finding that parenting predicted openness, conscientiousness, and, to a lesser degree, agreeableness is policy relevant because these traits predict important life-course outcomes, including educational and economic success and mental and physical health (Borghans et al., 2008; Ozer & Benet-Martínez, 2006; Roberts et al., 2007; Soto, 2019). Furthermore, these traits, reflecting patience, tolerance, and kindness, are also vital for the functioning and well-being of communities. Our findings suggest that interventions that increase positive parenting could therefore have small but sustained positive impacts on individuals and society.

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