

Predicting Educational and Social–Emotional Outcomes in Emerging Adulthood From Intelligence, Personality, and Socioeconomic Status

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Emerging adulthood describes the developmental life stage between adolescence and adulthood, when young people gain important educational and social–emotional skills. Here, we tested to what extent intelligence and personality traits in adolescence, family socioeconomic status (SES), and their interplay predict educational (e.g., educational attainment, degree classification) and social–emotional outcomes (e.g., well-being, volunteering, substance use) in emerging adulthood in a U.K.-representative sample ($N = 2,277$). Intelligence, personality traits, and family SES accounted together for up to 23.5% ($M = 9.7%$) of the variance in emerging adulthood outcomes. Personality traits, including the Big Five, grit, curiosity, and ambition, were the most consistent and strongest predictors across outcomes, although intelligence was a better predictor of educational attainment. Intelligence, but not personality, accounted for a significant proportion of the associations between family SES with educational attainment, degree classification, behavior problems, aggression, and volunteering (16.4%–29.1%). Finally, intelligence, ambition, conscientiousness, curiosity, and openness were all stronger predictors of educational attainment at low compared to high SES levels. These significant interactions suggest that these traits may help compensate for family background disadvantage, although the corresponding effect sizes were small ($R^2 = 0.4\%–3\%$). Overall, our analyses suggested that there is moderate developmental continuity from adolescence to emerging adulthood. Our findings contribute to understanding the psychological characteristics and structural factors that help emerging adults to become resilient and productive members of society.

Keywords: emerging adulthood, educational attainment, social–emotional adjustment, intelligence, personality

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The term “emerging adulthood” was coined to describe the extended transition from adolescence to adulthood, roughly during the ages of 18–29 years, that young people in Western populations now experience (Arnett, 2000). During this life period, emerging adults make choices and develop the characteristics that help them to live independently from their parents, start a career, form mature relationships and reorganize existing ones, and learn to take responsibility (Arnett, 2006; Tanner, 2006; Wood et al., 2018). There is no

standard trajectory through emerging adulthood (Schoon, 2015), and young people may take “many paths” through this life stage (Arnett, 2015).

The educational choices and social–emotional functioning of emerging adults set the foundation for their opportunities and outcomes across the lifespan (Arnett, 2007; Department for Education, 2018; Nelson & Padilla-Walker, 2013). Prior studies have suggested that educational attainment and social–emotional

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This study’s methods, analysis plan, and hypotheses were preregistered on the Open Science Framework (OSF) prior to analysis and access to the data set: <https://osf.io/mtn94>. All questionnaires and tests used in this study are publicly available on the TEDS data dictionary (<https://www.teds.ac.uk/datadictionary/home.htm>). In line with the TEDS data access policy, data can be accessed after completing a data access request (<https://www.teds.ac.uk/researchers/teds-data-access-policy>).

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functioning in emerging adulthood are likely to be predicted by intelligence, personality traits, and family socioeconomic status (SES; e.g., Gale et al., 2012; Newcomb-Anjo et al., 2017; O'Connor et al., 2011; Poropat, 2009; Roberts & DelVecchio, 2000; Strenze, 2007; Voncina et al., 2018) but the corresponding empirical evidence is fragmented and inconclusive to date, mainly for three reasons.

First, very few studies have comparatively tested the associations of intelligence, personality traits, and family SES with emerging adulthood outcomes, and those that have tended to focus only on educational attainment and achievement (e.g., Damian et al., 2015; Richardson et al., 2012; Shanahan et al., 2014). To our knowledge, no previous study has explored the relative relations of intelligence, personality, and family SES with both educational and social-emotional outcomes in emerging adulthood. Second, few studies have relied on longitudinal designs to test the long-term prediction of intelligence, personality, and family SES for emerging adulthood outcomes (e.g., Damian et al., 2015; Fergusson et al., 2008; O'Connor et al., 2011). Therefore, despite the consensus that adolescence is critical for the successful transition to adulthood (Eccles et al., 2003), our understanding of the role of adolescent individual differences in emerging adulthood is limited. Third, few studies tested whether and how family SES may interact with individual differences like intelligence and personality in the prediction of emerging adulthood outcomes (Damian et al., 2015; Fergusson et al., 2008; Shanahan et al., 2014). This omission is particularly striking, given the widespread acknowledgment that the opportunities afforded to, and experiences faced by emerging adults vary greatly because of their family background (Gibb et al., 2012; Landberg et al., 2019). Understanding if and how family SES affects associations of intelligence and personality traits with emerging adulthood outcomes is key to designing effective interventions that benefit lifespan development and help ameliorate family background inequality.

Here, we report results from analyses of data from the Twins Early Development Study (TEDS), a U.K. representative, longitudinal cohort study that assessed family SES in early childhood, intelligence and personality at age 16, and a wide range of educational and social-emotional outcomes at age 23 years. Our findings shed light on the relative importance of intelligence, personality, family SES, and their interplay, for adolescents maturing into high attaining and well-functioning adults. Below we first summarize the concept of emerging adulthood and then discuss previous findings on the prediction and interplay of intelligence, personality, and family background for educational and social-emotional outcomes during emerging adulthood.

Emerging Adulthood

For young people in Western and industrialized societies, the transition from adolescence to adulthood has become increasingly prolonged. More young people than ever are entering tertiary education (Department for Education, 2019) and delaying the start of their careers, marriage, and childbirth (Organisation for Economic Co-operation and Development [OECD], 2020). They now spend their twenties exploring various education and work options and social and romantic relationships, rather than committing to long-term employment and starting families as was customary 50 years ago. To describe this extended life period between the

ages of 18 and 29 years, the term “emerging adulthood” was coined, which is characterized by five interconnected features (Arnett, 2000, 2004). The first, *identity explorations*, refers to having the freedom to try out different experiences in relationships and work, which sets the experiential foundation for making enduring choices in both domains in later adulthood. Second, emerging adulthood is a time of *instability*, as these identity explorations stand in the way of making commitments to long-term relationships and occupations. Third, *self-focus* refers to the greater autonomy of emerging adults to make decisions, away from parental expectations and from the obligations of marriage or parenthood that are thought to characterize later established adulthood (Mehta et al., 2020). Fourth, it is the period of *feeling in-between*, being neither adolescent nor adult. Finally, this *age of possibilities* implies a wide range of available pathways and futures, because there is no standard trajectory through emerging adulthood. Overall, emerging adulthood constitutes a critical juncture in human development that forecasts individual differences in developmental outcomes across the entire life course (Lott, 2019; Padilla-Walker & Nelson, 2017; Tanner, 2006).

Educational Outcomes

Emerging adults, who have completed compulsory schooling, choose from a diverse range of available education paths. In the United Kingdom, prior to the COVID-19 pandemic, approximately 50% of school leavers enrolled in tertiary education, about 10% attended a further education college or another nontertiary institution, around 6% took up an apprenticeship, and 22% directly entered employment without enrolling in further education or training (Department for Education, 2018). The remaining 12% of emerging adults can be classified as not being in education, employment, or training (NEET; Powell, 2018). These different educational pathways translate into differences in long-term employment, earning potential, and health outcomes. Obtaining a university degree is linked with advanced career trajectories and high earnings across the lifespan (OECD, 2020), as well as with better health outcomes and longer life expectancy (Olshansky et al., 2012). Higher degree performance (Jones & Jackson, 1990) and university prestige (e.g., university league table ranking) are also related to increased earnings (Britton et al., 2020; Hoekstra, 2009). Obtaining higher level vocational qualifications, such as advanced apprenticeships, support direct entry to the labor market in skills-based economies, facilitating advantageous employment opportunities (Hanushek et al., 2017; Kirby, 2015). By comparison, NEET status is associated with the worst earning and career prospects, including long-term unemployment and chronic physical and mental health problems (Powell, 2018).

Social-Emotional Outcomes

Social-emotional development is a multidimensional construct that describes an individual's ability to internally regulate and outwardly express their emotions, form and maintain healthy relationships, and to adapt to social norms and demands (Halle & Darling-Churchill, 2016). Although there is no set definition, some markers of social-emotional development of particular relevance to emerging adulthood include well-being, substance use, self-control, risk-taking, and avoiding conflict with the law. Previous studies have shown that many emerging adults experience high levels of well-being (Galambos et al., 2006; Galambos & Krahn, 2008), initiate and

maintain respectful peer and romantic relationships (Padilla-Walker & Nelson, 2017), and engage in prosocial behaviors like volunteering (Barry et al., 2008). However, emerging adulthood is also a peak time for experiencing mental health issues (Conley et al., 2020; Kessler et al., 2007), for experimenting with risky sexual practices (Lam & Lefkowitz, 2013), alcohol and drug use (Andrews & Westling, 2016), and antisocial behavior and crime (Craig & Piquero, 2016). In line with these seemingly conflicting findings, one study suggested emerging adults can be thought of as either “floundering” or “flourishing” (Nelson & Padilla-Walker, 2013): floundering individuals were found to engage in high levels of binge drinking, drug use, and risky sexual behavior and to experience poor well-being, but the flourishing group did not.

The social-emotional functioning of emerging adults predicts their later adjustment throughout adulthood. For example, engaging in prosocial behaviors in one’s twenties, like volunteering, is positively associated with emotional health and satisfaction with life and relationships a decade later, whereas the opposite pattern was observed for those who engaged in criminal activity or risky sex (Lott, 2019). Social-emotional functioning in emerging adulthood has also been linked to later occupational success (Samuel, Bergman, et al., 2013; Thompson et al., 2019), relationship quality (Davila et al., 2017), and psychological functioning (Salmela-Aro et al., 2008; Schulenberg & Zarrett, 2007). In sum, social-emotional adjustment during emerging adulthood is likely to pave the way for the successful transition to adulthood and help navigating the unique challenges that it presents.

Socioeconomic Context

Although the theory of emerging adulthood emphasizes the freedom of choice (cf. identity explorations), young people differ substantially in the opportunities that are available to them (Côté, 2014; Hendry & Kloep, 2010), such as the affordability of and access to higher education. As a result, socioeconomic inequalities can influence the ways in which young people experience and engage with emerging adulthood (Gibb et al., 2012; Landberg et al., 2019). For example, emerging adults from financially less secure family backgrounds might be required to transition more quickly to established adulthood roles, such as working a full-time job or starting a family. As a result, they would have fewer opportunities for identity explorations, which can have a knock-on effect on their educational attainment and social-emotional adjustment (Kendig et al., 2014). The influence of family background on emerging adulthood outcomes is often indirect, in the way that it is explained in part by individual differences in intelligence and personality traits (e.g., Fergusson et al., 2008; Shanahan et al., 2014; Tucker-Drob, 2013). In addition, family SES may moderate the associations of individual differences in intelligence and personality with educational and social-emotional outcomes (e.g., Damian et al., 2015; Shanahan et al., 2014). Studying the interplay of individual differences in intelligence and personality with family SES grants us a more comprehensive understanding of the processes that predict emerging adulthood outcomes.

Predictive Validity of Intelligence

Intelligence, the general ability to reason, think logically, and solve problems, is relatively stable across the lifespan (Deary et al.,

2000, 2013), which makes it possible to use intelligence test scores from childhood and adolescence to predict outcomes later in life. Intelligence is the strongest predictor of educational achievement and attainment (Deary et al., 2007; Deary & Johnson, 2010; Roth et al., 2015; Sternberg et al., 2001; Strenze, 2007). A meta-analysis of 162 studies, with data from 105,185 children enrolled in elementary up to high school, reported a correlation of .54 between intelligence and school performance (Roth et al., 2015). Another meta-analysis of 20 longitudinal studies ($N = 26,504$) found that intelligence in childhood and adolescence correlated .56 with educational attainment later in adulthood (e.g., years spent in education; Strenze, 2007). However, at higher levels of education, the predictive power of intelligence for educational achievement [e.g., degree classification or university grade-point average (GPA)] reduces, with a meta-analytic correlation of .20 ($N = 7,820$; Richardson et al., 2012). Thus, intelligence continues to play a significant role in tertiary education but differentiates less than at primary and secondary levels, presumably because tertiary education students have already been selected for intelligence (Farsides & Woodfield, 2003; Furnham & Chamorro-Premuzic, 2004; Furnham et al., 2003).

Intelligence supports coping with all kinds of demands of modern life (Gottfredson, 1997); accordingly, it may also relate to social-emotional functioning in emerging adulthood. Indeed, childhood intelligence has been found to predict vulnerability to mental health problems and substance use (Gale et al., 2012; Martin et al., 2007; Osler et al., 2007; Zammit et al., 2004), as well as bullying perpetration and victimization (Huepe et al., 2011). Some studies also suggested that higher childhood intelligence is related to better mental health (Huepe et al., 2011), enhanced self-control (Boisvert et al., 2013; Meldrum et al., 2017), and fewer conduct problems (Kandel et al., 1988; Moffitt et al., 1981). Furthermore, intelligence has been associated with anti- and prosocial behavioral adjustment (Beaver et al., 2013; Guo et al., 2019; James, 2011). For example, in a longitudinal and U.S. representative study of 15,701 young people, intelligence in adolescence was negatively related to criminal behavior in emerging adulthood (Beaver et al., 2013), while other studies observed positive associations with prosocial behaviors like volunteering and charitable giving (Guo et al., 2019; James, 2011). Most previous studies in this area focused on predictions from childhood for adolescence, not emerging adulthood. Yet, these studies’ relatively coherent pattern of results supports the idea that intelligence benefits social-emotional adjustment in emerging adulthood.

Predictive Validity of Personality

While intelligence captures an individual’s ability or their “maximum” performance—that is, what they “can” do—personality traits describe their “typical” performance or what a person tends to do (Fiske & Butler, 1963; von Stumm et al., 2011). The predictive validity of personality traits is now widely recognized and known to rival that of cognitive ability (Roberts et al., 2007). Many studies have shown that personality traits are associated with educational attainment and achievement (e.g., Krapohl et al., 2014; Poropat, 2009; Vedel, 2014), especially at higher education levels when intelligence has become less predictive (Furnham et al., 2003). Of the Big Five personality traits (Goldberg, 1992), conscientiousness has emerged as the strongest predictor of educational attainment

(Damian et al., 2015) and achievement (Nofle & Robins, 2007; Poropat, 2009; Richardson et al., 2012; Vedel, 2014). During tertiary education, the association of conscientiousness with achievement even exceeds that of intelligence ($r = .23$ vs. $r = .21$; Richardson et al., 2012; see also Conard, 2006; Poropat, 2009; Powell, 2018). Conscientiousness includes facets of competence, order, dutifulness, achievement striving, self-discipline, and deliberation (Costa & McCrae, 1992), all of which plausibly benefit educational success (Roberts et al., 2009; Sorić et al., 2017). With regard to the other Big Five traits, a large-scale meta-analysis found that after controlling for intelligence, agreeableness had a small positive association with university performance ($r = .06$; Poropat, 2009), but extraversion ($r = -.01$; Poropat, 2009) and neuroticism ($r = -.01$; Poropat, 2009) were not meaningfully associated. Openness to experience, which incorporates sensation seeking and perception on the one hand, and intellectual engagement and curiosity on the other (DeYoung et al., 2005, 2009)—is positively associated with achievement, albeit more strongly during primary ($r = .18$) than tertiary education ($r = .06$; Poropat, 2009). Overall, these findings suggest that from the Big Five, conscientiousness and openness to experience most strongly predict educational achievement in emerging adulthood.

Other trait domains that are not included in the Big Five have also been related to outcomes in emerging adulthood. For example, grit, a trait that resembles conscientiousness and refers to perseverance and a commitment to long-term goals, has been shown to predict educational achievement and attainment in emerging adulthood (Akos & Kretchmar, 2017; Duckworth et al., 2007; Duckworth & Quinn, 2009). For example, grit accounted on average for 4% of the variance in educational attainment level in adulthood and undergraduate GPA (i.e., achievement; Duckworth et al., 2007), although it is unclear whether grit has incremental validity above the prediction by conscientiousness (Rimfeld et al., 2016; Schmidt et al., 2018). Likewise, ambition, defined as goal setting, striving for success, and accomplishment, positively predicts educational attainment and university prestige (Judge & Kammeyer-Mueller, 2012) but again, it is likely to map a similar construct space as conscientiousness (Roberts et al., 2009; Sherman et al., 2017).

To date, no integrated, comprehensive understanding has emerged of the role of personality traits for social-emotional adjustment in emerging adulthood, mainly because most previous studies in this area explored only one or two social-emotional measures (e.g., Gullone & Moore, 2000; Hakulinen et al., 2015; Jones et al., 2011; Mezquita et al., 2018; Voncina et al., 2018). The trait dimension that emerges most reliably as a predictor of social-emotional outcomes, in particular well-being and substance use, is neuroticism. In a meta-analysis with 122,588 participants, neuroticism accounted for up to 39% of the variance in quality-of-life measures, with higher neuroticism being associated with lower subjective well-being (Steel et al., 2008). This relationship has also been reported in emerging adults ($N = 220$; Voncina et al., 2018). Positive associations have also been reported between neuroticism and depressive symptoms in a meta-analysis ($N = 117,899$ adults; Hakulinen et al., 2015) as well as for alcohol use ($N = 1,280$; Mezquita et al., 2018). Extraversion, grit, and conscientiousness have also been linked to well-being in emerging adulthood (Arya & Lal, 2018; Datu et al., 2019; Hakulinen et al., 2015; Steel et al., 2008), but these findings are yet to be replicated.

With regards to risk-taking behaviors, extraversion and conscientiousness are frequently found to be associated. For example, in a cross-sectional study of 459 adolescents, extraversion was the strongest predictor of thrill seeking ($\beta = .230$), whereas low conscientiousness best predicted reckless ($\beta = -.140$) and rebellious behaviors ($\beta = -.0190$; Gullone & Moore, 2000). Extraversion has also been linked to risky sexual behaviors. One large study spanning 52 countries with 16,362 participants concluded that extraversion increased the likelihood of sexual promiscuity in adults in Western countries (Schmitt, 2004); this relationship has also been shown for emerging adults too (Miller et al., 2004). Openness is another trait that has been associated with sexual behaviors in emerging adulthood, such as using contraception (Miller et al., 2004), although the empirical evidence for its role is inconsistent (Schmitt, 2004; Turchik et al., 2010).

Finally, agreeableness has been consistently linked with external adjustment, including both prosocial and antisocial behaviors. For example, agreeableness predicts volunteering (Graziano & Habashi, 2010; Habashi et al., 2016) and reduces the likelihood of engaging in antisocial behaviors, together with high conscientiousness and low neuroticism (Jones et al., 2011). This combination of traits was also associated with a lower probability of being convicted of a crime in adulthood (O'Riordan & O'Connell, 2014). Overall, these findings suggest that many personality traits are involved in social-emotional adjustment in emerging adulthood, in different ways and with varying effect sizes. Although some evidence points to the importance of neuroticism and extraversion in particular (e.g., Gullone & Moore, 2000; Voncina et al., 2018), the broad, multifactorial nature of social-emotional adjustment makes it likely that all broad personality trait domains, as well as their narrower facets, meaningfully contribute to development in emerging adulthood.

The Role of Family Socioeconomic Status

Beyond the influence of psychological traits like intelligence and personality, emerging adulthood outcomes are shaped by structural opportunities and the constraints that follow, at least in part, from one's family SES (Arnett, 2006; Hendry & Kloep, 2010; Landberg et al., 2019). A well-established finding is that children from lower SES families are less likely to enroll in post-compulsory education than their more privileged counterparts (Harrison, 2017; Richardson et al., 2020). This gap is most pronounced at tertiary education levels and prestigious universities: Children with professional parents are three times more likely to enter a high-status university like Oxford or Cambridge, than those with working-class parents (Jerrim et al., 2015).

Longitudinal studies have corroborated that family SES strongly predicts educational attainment in emerging adulthood. For example, childhood SES correlated .62 with the highest qualification achieved by age 25 in a birth cohort of over 1,000 children from New Zealand (Fergusson et al., 2008). Similarly, a meta-analysis of 17 longitudinal studies ($N = 69,082$) reported a correlation of .55 between childhood SES and educational attainment in adulthood (Strenze, 2007). By comparison, the association between family SES and educational achievement, for example, GPA or degree performance, is only of medium effect size (e.g., meta-analytic .24 in 139,345 first-year undergraduates; Westrick et al., 2015). These findings suggest that SES better predicts emerging adults' level of educational attainment than their performance *within* education levels.

Family SES is also related to social–emotional development (e.g., Bradley & Corwyn, 2002). Across the lifespan, those from lower SES backgrounds are more likely to experience poorer social–emotional functioning than their more affluent counterparts (McLeod & Shanahan, 1993; McLoyd, 1997; Wills et al., 1995), presumably because they are exposed to greater environmental stress, such as malnutrition and neglect, while receiving less social support (Call & Nonnemaker, 1999; McLeod & Shanahan, 1993; McLoyd, 1997). The relationship between family SES and social–emotional development continues into emerging adulthood (Arnett, 2015; Hendry & Kloep, 2010; Newcomb-Anjo et al., 2017; O’Connor et al., 2011). For example, emerging adults from low SES families are more likely to report feeling depressed (Arnett, 2015) and to show decreased social competence (i.e., behavioral problems), civic engagement (i.e., prosocial behaviors), and life satisfaction (O’Connor et al., 2011). However, these findings conflict with other observations that young adults from low SES backgrounds engage more often in prosocial behaviors, such as being more generous, charitable, and helpful to others (Piff et al., 2010), because they value cooperation to a greater degree than those from privileged backgrounds, who are more independent minded (Harackiewicz et al., 2014; Stephens et al., 2012). Finally, there appear to be weak associations between family SES and externalizing facets of social–emotional adjustment, such as aggressive or criminal behavior (Dunaway et al., 2000; Letourneau et al., 2011; O’Riordan & O’Connell, 2014). For example, a meta-analysis of seven studies found a small negative relationship between aggression and SES in adolescents (Hedges’s $g = 0.06$), but three of the seven studies did not detect a significant effect (Letourneau et al., 2011). Overall, a large body of empirical evidence substantiates that family SES is associated with educational and social–emotional outcomes in emerging adulthood, although no previous study tested how family background relates to emerging adulthood across a broad range of outcomes.

Interplay of Family SES With Intelligence and Personality

Family SES is likely to affect educational and social–emotional outcomes through different pathways (e.g., Tucker-Drob, 2013). For example, family background may become associated with children’s educational outcomes, because of the values and aspirations that their parents instill in them, such as being studious and hardworking (i.e., conscientiousness). In this case, a family’s values would explain, at least partly the association, between family SES and children’s education, akin to mediation effects. Family SES may also moderate influences on emerging adulthood outcomes (i.e., interaction models). For example, the association between conscientiousness and performing well in school may be greater in children from high SES families, who receive more praise for working hard in school, than in children from lower SES families, whose academic efforts are less often lauded.

One well-studied pathway from family SES to educational outcomes is via intelligence. The results of several studies are consistent with a model positing cognitive ability as a partial mediator of the relationship between family SES and children’s educations (Fergusson et al., 2008; von Stumm, 2017; von Stumm & Plomin, 2015). For example, in a New Zealand birth cohort,

35% of the variance in the association between childhood SES and educational attainment in emerging adulthood ($r = .62$) was accounted for by childhood intelligence (Fergusson et al., 2008). Because 65% of the variance in the association between SES and educational attainment could not be attributed to intelligence, SES is likely to also influence education through other pathways, such as personality traits. For example, having highly educated parents—with education serving as a proxy for family SES—is associated with developing more favorable personality profiles, including being less neurotic and more open and conscientious (Jonassaint et al., 2011; Sutin et al., 2017). Another study found in 13,962 emerging adults that agreeableness and neuroticism partially accounted for the relationship between their educational attainment and that of their parents (a proxy for family SES; Shanahan et al., 2014). Across studies, intelligence emerges overall as an important pathway by which family SES becomes associated with later educational attainment, while personality traits are likely to account for only a small proportion of the relation. For social–emotional functioning, no prior study has systematically tested if and to what extent intelligence and personality account for the association with family SES.

Family SES may predict outcomes in emerging adulthood by interacting with intelligence and personality, such that individual differences may have stronger or weaker effects at different levels of family SES. In this context, two contrasting hypotheses have been proposed. The resource substitution hypothesis posits that intelligence and personality traits will be stronger predictors of attainment at lower levels of family SES, because a specific resource (e.g., high intelligence) becomes more salient at lower levels of another critical resource (e.g., family SES; Mirowsky & Ross, 2003). Thus, being intelligent and having favorable personality traits will benefit in particular individuals with fewer alternative resources, giving rise to compensatory effects for background disadvantage. However, for those from higher SES backgrounds, these traits matter less for development because they can rely on other resources and privileges. The alternative hypothesis is known as the Matthew effect (Merton, 1968), which suggests that intelligence and personality will be stronger predictors at higher levels of SES. This is because well-resourced environments enhance the positive effects of certain traits (i.e., “the rich get richer”).

We identified two prior studies that directly tested the resource substitution and Matthew effect hypotheses in the context of educational attainment in emerging adulthood, one analyzing cross-sectional data (Shanahan et al., 2014) and the other a population cohort who attended high school in 1960 (Damian et al., 2015). For personality, both studies reported resource substitutions, with conscientiousness, extraversion, and agreeableness having stronger effects on educational attainment at lower levels of parental SES (Damian et al., 2015; Shanahan et al., 2014). These interaction effects were small and not enough to fully compensate for the influence of low parental SES. For intelligence, the Matthew effect better explained the data, with intelligence being associated with almost a whole year more of education in children from high SES family backgrounds compared to those from low SES homes (Damian et al., 2015).

To date, these findings have not been confirmed in a longitudinal study of a younger generation. Also, there has been no

comprehensive or systematic exploration of the resource substitution and Matthew effect hypotheses for social–emotional outcomes. That said, one study of 666 adults showed that neuroticism and extraversion were significantly stronger predictors of well-being for those who concurrently suffered less deprivation, suggesting these traits may be protective against the negative influence of low SES on well-being (Packard et al., 2012). In summary, it is plausible that associations of intelligence and personality with emerging adulthood outcomes are moderated by family background but the scarcity of prior empirical evidence in this area recommends exploratory analyses, rather than a-priori hypothesis testing.

The Present Study

We tested the predictive validity of adolescent intelligence and personality traits, and family SES, as well as their interplay for educational and social–emotional outcomes in emerging adulthood. Data came from TEDS, whose participants were assessed on a broad range of emerging adulthood outcomes, comprising a broad range of social–emotional outcomes, including well-being, behavioral problems, risky behaviors, peer victimization, substance use and anti-social behaviors, and three markers of educational attainment and achievement, namely, highest qualification achieved, university rank, and degree performance.

We predicted that adolescent intelligence and personality traits, and family SES would account for significant variance in all emerging adulthood outcomes. Based on previous research, we anticipated that intelligence would be a stronger predictor than the personality of educational attainment (i.e., highest educational qualification, going to university, university rank), although conscientiousness may emerge as stronger predictor of university performance (Richardson et al., 2012). We also predicted that personality traits would explain more variance in social–emotional outcomes than intelligence, with specific traits being differentially strongly associated with the various social–emotional outcomes.

We then tested whether intelligence and personality traits accounted for a significant proportion of the association between family SES and educational and social–emotional outcomes in emerging adulthood. We predicted that intelligence would partly explain the association between family SES and educational outcomes (Fergusson et al., 2008). Based on Shanahan et al. (2014), we also anticipated that neuroticism would partially account for the link between family SES and educational, and social–emotional outcomes (e.g., Steel et al., 2008). For the effects of other personality traits, our analyses were largely exploratory.

Lastly, we tested whether family SES moderated the associations of intelligence and personality with educational and social–emotional outcomes in emerging adulthood. We predicted that family SES would moderate the associations of intelligence with educational outcomes according to the Matthew effect (Damian et al., 2015), but we did not expect significant interactions between SES and intelligence on social–emotional outcomes. We also anticipated that family SES would moderate the associations of neuroticism with educational outcomes according to the resource substitution hypothesis (Shanahan et al., 2014) and with several social–emotional outcomes, including well-being (Packard et al., 2012).

Method

Transparency and Openness

This study's methods, analysis plan, and hypotheses were pre-registered prior to analysis, and the analysis code was uploaded: <https://osf.io/mtn94>. All questionnaires and web tests used in this study are publicly available on the TEDS data dictionary (<https://www.teds.ac.uk/datadictionary/home.htm>). Based on the terms of the TEDS data access policy, researchers gain data access after completing a corresponding request form (<https://www.teds.ac.uk/researchers/teds-data-access-policy>). Data were analyzed using R, Version 4.0.5 (R Core Team, 2020), with the package *lavaan*, Version 0.6-9 (Rosseel, 2012) used to test our models, and *ggplot2*, Version 3.3.5 (Wickham, 2016) to design our figures.

Sample

The present sample was drawn from TEDS, which initially recruited more than 10,000 twin pairs born between January 1994 and December 1996 in England and Wales. TEDS and the consent procedure were approved by the King's College London ethics committee (ref: PNMI/09/10-104). The recruitment process and sample are described in detail elsewhere (Rimfeld et al., 2019). The representativeness of the TEDS twins to the U.K. population has been demonstrated in infancy, early childhood, middle childhood, adolescence (Haworth et al., 2013; Kovas et al., 2007), and in early adulthood (Rimfeld et al., 2019). For example, percentages of TEDS participants are similar to the U.K. national averages for enrolling in university (56% vs. 49%) and obtaining a first-class degree (33% vs. 26%).

We excluded twins who experienced severe medical complications during the first 2 years of life or whose mothers reported severe medical problems during pregnancy from our analyses. We also excluded twins for whom data on intelligence and personality traits at age 16 were not available. After exclusions, we randomly selected one twin from each pair for our analysis sample, resulting in a maximum of 2,277 unrelated individuals. To test the robustness of our findings, we reran our analyses in a second sample of the other randomly selected twin from a pair ($N = 2,281$).

Our main analysis sample included 59% females at age 16 and 64% females at age 23 (41% and 36% males, respectively). As is typical in longitudinal studies, TEDS has suffered some attrition over time. Accordingly, TEDS participants who contributed data at age 16 and 23 reported on average higher family SES ($N = 1,668$, $M = 0.29$, $SD = 0.98$) than those who contributed data only at age 16, $N = 609$, $M = 0.11$, $SD = 0.97$; $t(2,165) = 3.59$, $p = .0003$; Cohen's $d = 0.18$, who were on average still of higher SES than the TEDS sample at inception ($M = 0$, $SD = 1$).

Measures

Intelligence

At age 16, participants completed web-based adaptations of Raven's Standard and Advanced Progressive Matrices (Raven et al., 1996) and the Mill Hill Vocabulary scale (Raven et al., 1998). Raven's matrices assess nonverbal ability: Participants were presented with a series of incomplete patterns and asked to identify the missing part of the pattern from eight possible options. Thirty items were administered with a Cronbach's alpha of $\alpha = .79$.

The Mill Hill Vocabulary scale consisted of 33 items to assess verbal ability: Participants were presented with a series of words and asked to choose the word closest in meaning to the target one from six possible options. The Cronbach's alpha for this test was $\alpha = .82$. The total number of correct answers from both tests were z standardized, and then the mean calculated to compute an overall intelligence composite for each participant.

Personality

At age 16, participants were assessed on four different measures of personality traits, administered as part of a web-based questionnaire that they completed at home.

The Big Five. Participants completed the abbreviated version of the Five-Factor Model [Five-Factor Model Rating Form (FFMRF); Mullins-Sweatt et al., 2006], rating themselves on a 5-point scale (e.g., 1 = *extremely low* and 5 = *extremely high*) for 30 items assessing neuroticism, extraversion, openness, agreeableness, and conscientiousness (i.e., six items for each personality trait). Scores were added across items per trait and averaged. The FFMRF has been reported to be a reliable and valid assessment of the Big Five personality traits (Samuel, Mullins-Sweatt, et al., 2013).

Curiosity. Participants were administered the Curiosity and Exploration Inventory (CEI), a seven-item instrument that assesses both exploration (appetite for novelty and challenge) and absorption (full engagement in specific activities; Kashdan et al., 2004). For example, an exploration item was "Everywhere I go I am out looking for new things or experiences" and an absorption item was "When I am actively interested in something, it takes a great deal to interrupt me." Participants rated their agreement for each item on a 7-point scale (e.g., 1 = *strongly agree* and 7 = *strongly disagree*). Scores were added across items and averaged.

Grit. Participants completed the Grit-S questionnaire (Duckworth & Quinn, 2009), which includes eight items assessing perseverance of effort (four items) and consistency of interest (four items) on a 5-point scale which ranged from 1 (*very much like me*) to 5 (*not like me at all*). For example, a perseverance item was "Setbacks don't discourage me" and consistency of interest item was "I finish whatever I begin." Scores were added and a mean grit score was computed.

Ambition. Participants completed a five-item ambition scale that was developed by Duckworth and colleagues but was not published or incorporated in the original Grit-S scale (items taken from Moore et al., 2018). For example, an item reads "I am driven to succeed." Participants rated their agreement on a 5-point scale from "very much like me" (1) to "not at all like me" (5). Scores were added and a mean ambition score was computed.

Socioeconomic Status (SES)

Family SES was assessed at first contact when the TEDS children were 18 months old. Parents reported their educational qualifications and occupations, and the twins' mother reported her age at the birth of her first child. Educational qualifications ranged on an 8-point scale from "no formal education" to "postgraduate qualifications." Occupation was inferred based on the standard classification (Office of Population & Census Surveys, 1991), using participants' reports of their employment status, job title, employment type (e.g., manager, self-employed), and whether they needed special

qualifications for their role. The mother's age at first birth has one of the strongest associations with women's SES (van Roode et al., 2017). Standardized mean scores were calculated for each measure and averaged to compute an SES composite for each participant.

Educational Outcomes

At age 23, participants reported on their educational attainment and if relevant, university achievement, in a web-based questionnaire designed by the TEDS researchers. At age 18, participants also reported what university they were attending, if they were going to university.

Educational Attainment. Participants reported (a) their highest educational qualification which was recoded into ordinal variables on 11-point scale, from no qualifications (0) to doctoral degree (11). If participants were still in education, they also reported (b) the highest education level they were currently working toward. Based on these two variables, a composite of the highest educational level was produced.

University Achievement. Participants who went to university, reported if they had completed their undergraduate degree and what grade they obtained, which was standardized on a 5-point scale. Degree classifications ranged from a pass (1), third class (2), lower second class (3), upper second class (4) to first class (5).

University Rank. At age 18, TEDS twins named the university from which they had received an offer and that they intended to attend. We used this information to create a university rank order based on the U.K. university league table in 2014 (the year that the majority of the sample applied to university; The Complete University Guide, 2014), akin to Smith-Woolley et al. (2018). This ranking system considers the entry standards of the university, the average Universities and Colleges Admissions Service (UCAS) points of students at the university, research output, and graduate prospects. According to this ranking system the University of Cambridge was at the top, and East London University was at the bottom, with 124 universities in total. Scores were reversed so a higher number indicated a more prestigious university.

Social-Emotional Outcomes

At age 23, participants completed web-based questionnaires to assess 14 social-emotional outcomes, which are described briefly below.

Well-Being. Participants completed the short version of the Mood and Feelings Questionnaire (MFQ; Angold et al., 1995), a 13-item scale that assesses feelings or behaviors that characterize low well-being over the past 2 weeks, using a 3-point scale ["not true" (0), "quite true" (1), and "very true" (2)]. An example item reads "I didn't enjoy anything at all." An overall score was computed by summing responses and reversed, so that higher values indicate greater well-being.

Behavior Problems. Behavior problems were assessed with the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), a 25-item scale that measures emotional and behavioral problems on a 3-point scale ["not true" (0), "quite true" (1), and "very true" (2)]. For example, an item reads "I get very angry and often lose my temper." An overall score was computed by summing responses (reversed where necessary).

Purpose in Life. Participants completed 5-items from the Purpose in Life scale (Crumbaugh & Maholick, 1964), which assesses how individuals feel about their life worth, meaning, and purpose. For example, an item reads “I feel my personal existence is” and participants rated on a 5-point scale where they fall on a spectrum of “utterly meaningless, without purpose” (1) to “purposeful and meaningful” (5). An overall mean score was computed, with a higher score indicating higher life purpose and meaning.

Peer Victimization and Bullying. Peer victimization and bullying were assessed with the Multidimensional Peer Victimization Scale (Mynard & Joseph, 2000), a 16-item scale that assesses social manipulation, attacks on property, and verbal and physical victimization. Participants completed two versions; one where they reported how often they experienced victimization *from* their peers (i.e., they were bullied), and another where they reported how often they engaged in the victimization *of* their peers (i.e., they bullied others). They indicated how much each statement applied to their recent experiences on a 3-point scale [“not true” (0), “quite true” (1), and “very true” (2)]. Two overall scores, one for peer victimization and one for bullying, were computed by summing responses.

Volunteering. Volunteering was assessed with five items adapted from the “It’s all about you” questionnaire used in the Avon Longitudinal Study of Parents and Children (ALSPAC). These items included giving money to charity and providing unpaid help to organizations or individuals. Participants indicated how often they engaged in each behavior from “never” (0), “once or twice” (1), “3–6 times” (2), “7–12 times” (3), “13 times or more” (4). Responses were summed to produce an overall score.

Self-Control. Participants completed the Brief Self-Control Survey (Tangney et al., 2004), a 6-item scale that assesses how well respondents can override distractions using a 5-point scale from “not at all” (0) to “very much” (4). An example item reads “I am good at resisting temptation.” An overall score was computed by summing responses.

Risk-Taking. Risk-taking was assessed by six items from the Risk-Taking Index (Nicholson et al., 2005), which assesses the frequency of engagement of risk behaviors in health, recreation, career, finances, safety, and social relationships. An item reads “How often do you take financial risks (e.g., gambling, risky investments?).” Participants indicate how often they engage in each behavior from “never” (0), to “very often” (4), and responses were summed to compute an overall score.

Sexual Risk-Taking. Participants, who indicated they had sexual intercourse, completed four items designed by TEDS researchers to assess safe sex practices. They first reported (a) their age when they first had sexual intercourse, with answers ranging from “11 or younger,” to “12,” “13,” “14,” “15,” “16” and “17 or older” (0), which were reversed and converted to a 5-point scale, such that 11 or younger was recoded as high (4) and 17 or older as low (0). They then reported (b) how many sex partners they have had on a 5-point scale [i.e., “1 person” (1), “2–3 people” (2), “4–7” (3), “8–14” (4), “15 or more” (5)] as well as reporting (c) how often they used a condom on a 5-point scale from “never” (4) to “always” (0). Finally, they reported (d) how often they had been diagnosed with a sexually transmitted disease [“none” (0), “once” (1), “2–3 times” (2), “4–7 times” (3), “8+ times” (4)]. Scores were summed, with higher scores indicating higher sexual risk-taking. Those who reported not to have had intercourse received a sexual risk score of 0.

Aggression. Physical and verbal aggression was assessed with the eight items from the Brief Aggression Questionnaire using a 5-point scale from *strongly disagree* (1) to *strongly agree* (5; Webster et al., 2014). For example, an item reads “Given enough provocation, I may hit another person.” Scores were summed and averaged.

Antisocial Behavior. Participants indicated if and how often they engaged in 15 antisocial behaviors from “no” (0), “once” (1), “2–5 times” (2), “6–10 times” (3), to “more than 10 times” (4). The statements were adapted from the Edinburgh Study of Youth Transitions and Crime (McAra & McVie, 2010) and included destroying property and selling illegal drugs. An overall score was computed by summing responses.

Conflict With the Law. Participants completed three questions designed by TEDS researchers, answering yes (1) or no (0) to indicate if they had been cautioned by the police, if they had been arrested, and if they had ever been sentenced to prison. An overall score was computed by summing responses.

Alcohol Use. For those who indicated they had a whole drink before, participants completed 10 items adapted from the Alcohol Use Disorders Identification Test (AUDIT) developed by the World Health Organization (WHO; see <https://www.drugabuse.gov/sites/default/files/audit.pdf>). Questions included “during the past year, how often have you had six or more units of alcohol on one occasion?” where they answered on a 5-point scale from “never/almost never” (0), to “daily/almost daily” (4). An overall alcohol use score was computed by deriving the mean score of all items and multiplying this by the number of items (10) resulting in a range of values from 0 to 40. Participants, who indicated they had not had a whole drink before, received a score of 0.

Cannabis Use. Participants, who indicated they had tried cannabis answered this question: “In the last 12 months how often have you used cannabis?” on a 6-point scale from either “not in the last 12 months” (0), “once or twice” (1), “less than monthly” (2), “monthly” (3), “weekly” (4) or “daily or almost daily” (5).

Statistical Analysis

To handle missing data, we applied full information maximum likelihood estimation (FIML) in all models (Graham, 2009).

Predicting Emerging Adulthood Outcomes

We fitted hierarchical linear regression models to assess and compare the direct prediction of intelligence, personality traits, and family SES at age 16 for educational and social-emotional outcomes at age 23. We first controlled for within-cohort age variability at age 23 and gender (Model 0), before independently adding intelligence (Model 1), personality traits (Model 2), and family SES (Model 3). Finally, we modeled intelligence, personality, and family SES together (Model 4) to assess the total and independent contributions of all three predictors to each outcome.

Interplay of Intelligence, Personality, and Family SES in Predicting Emerging Adulthood Outcomes

To test if and to what extent intelligence and personality traits accounted for the associations between family SES and emerging adulthood outcomes, we conducted path analyses that are often

referred to as “mediation analyses” (Fiedler et al., 2011). Family SES was specified as predictor (X) and either intelligence or a personality trait as “mediator” (M) for each outcome (Y). We followed the approach of Baron and Kenny (1986), and we only tested path models where (a) SES (X) was a significant predictor of an outcome (Y); (b) SES (X) was significantly related to intelligence or a personality trait (M); and (c) intelligence or the personality trait (M) was a significant predictor of the outcome (Y). We used the results from the hierarchical regressions and correlations to identify the variables that met these criteria. To test if the associations between predictor and outcome and between Predictor \times Mediator and outcome were significant, we applied bootstrapping procedures with 1,000 samples and calculated confidence intervals (95%). Paths were considered significant if the intervals did not include zero.

Results of such path analyses are often misinterpreted: Observing significance for a putatively mediating variable does not prove that this variable is indeed a unique mediator of a given association (Fiedler et al., 2011). In the context of our analyses, it is, for example, possible that unmeasured variables (i.e., nontested mediators) confound the relation between mediator, predictor, and outcome (Fiedler et al., 2011; Kim et al., 2018; Rohrer, 2018). We caution that our analytical approach does not warrant causal inferences about mediation effects; instead, our models test to what extent intelligence and personality may account for variance in the associations between family SES and emerging adulthood outcomes.

Intelligence and Personality \times SES

To assess if the associations of intelligence or personality with emerging adulthood outcomes were moderated by family SES, we modeled interaction terms between SES and each individual difference domain (e.g., SES \times Intelligence, or SES \times Personality trait) after z transforming all variables in independent linear regression models. We controlled for within-cohort age variability at age 23 (also z transformed) and gender (Model 0) before entering the direct effects of intelligence and SES, or the personality trait and SES (Model 1) and then added their interaction terms (Model 2). To adjust for multiple comparisons, we utilized a Bonferroni corrected p value of .0056 (.05/9 predictors). This is a rather conservative adjustment but seemed appropriate given the large number of models tested.

Robustness Analyses

To test the robustness of our findings, we fitted all models in our main analysis sample made up of one twin randomly selected from a pair and replicated them in the second sample of the other randomly selected twins. We used two criteria to determine if the findings were robust. For one, we fitted a series of multigroup models, which were not preregistered, to confirm the results of Model 4 (linear regression), where covariates, intelligence, personality, and family SES were modeled together, across both samples of twins. We compared the fit of an unrestricted model, where all parameters were allowed to freely vary between both samples, to that of a model with all parameters constrained to be equal using analysis of variance (ANOVA) tests. If the latter was nonsignificant ($p > .05$), results were interpreted as robust across both samples. For the other, we

only interpreted associations as meaningful and reported them in our results when they emerged as significant in both samples of twins.

Results

We report results from our main analysis sample here and discuss any differences in findings between the samples below. Table 1 reports descriptive statistics and Cronbach's α for all study variables. Most variables were normally distributed (0 ± 1.5) but the distributions for antisocial behavior and conflict with the law are notably skewed, due to their occurrence being relatively rare in our sample. The distributions for peer victimization and bullying were also skewed. Figure 1 shows the correlation matrix for all variables after pairwise deletion. All correlations were in the expected direction, with more favorable outcomes (e.g., better well-being, higher educational attainment) being positively interrelated. For example, SES was positively associated with intelligence ($r = .33$), educational attainment ($r = .37$), and degree class ($r = .14$).

Predicting Emerging Adulthood Outcomes

Figure 2 displays the unique variance (R^2) accounted for by intelligence, personality traits, and family SES in each emerging adulthood outcome, respectively. The unique variance estimates were derived from Models 1, 2, and 3 for intelligence, personality and family SES respectively. The full results for Models 1 through 4 can be found in the Supplemental Materials in Table S1.

Personality traits, including the Big Five, grit, curiosity, and ambition, consistently accounted for the greatest amount of variance in the emerging adulthood outcomes, except for educational attainment, degree classification, and volunteering, which were more strongly predicted by intelligence. SES and intelligence were associated with fewer emerging adulthood outcomes than personality, their strongest associations being with educational attainment and degree classification. However, unlike the other educational outcomes, university rank was not well predicted by intelligence (0.8%) and SES (0.2%). Across the social-emotional outcomes, family SES and intelligence explained little variance Intelligence (IQ): 0%–2.6%; SES: 0%–2.4%). Altogether, intelligence, personality, and SES best predicted educational attainment (23.8%) while they were least predictive of conflict with the law (1.2%).

Personality traits accounted for the most variance in social-emotional outcomes, including for purpose in life (16%), behavior problems (15.7%), self-control (15.5%), well-being (12.4%), aggression (12.8%), and risk-taking (12.1%). With regard to trait-specific associations, neuroticism was most consistently significant for social-emotional outcomes. As expected, neuroticism negatively predicted well-being ($\beta = -.258, p < .001$), purpose in life ($\beta = -.172, p < .001$), and self-control ($\beta = -.091, p = .001$), but positively predicted behavior problems ($\beta = .251, p = .001$), peer victimization ($\beta = .146, p < .001$), aggression ($\beta = .132, p < .001$), bullying ($\beta = .097, p = .001$), and alcohol use ($\beta = .088, p = .003$). Conscientiousness did not explain much variance in social-emotional outcomes and was only significantly related to self-control ($\beta = .152, p < .001$) and risk-taking ($\beta = -.124, p < .001$). Ambition did not significantly predict any social-emotional outcomes, and no personality traits were significantly associated with university rank, cannabis use, or conflict with the law.

Table 1
Descriptive Statistics and Cronbach's Alpha for All Study Variables

Variable category	Measure	<i>N</i>	<i>n</i>	<i>M</i>	<i>SD</i>	Min	Max	Skew	Kurtosis	α^a	
Predictors	SES	2,167	5	0.24	0.98	-2.3	2.65	-0.01	-0.79	—	
	IQ	2,277	63	0.04	1.01	-2.86	4.06	0.30	0.15	—	
	Neuroticism	2,277	6	2.57	0.68	1.00	4.83	0.25	-0.17	.70	
	Extraversion	2,277	6	3.68	0.57	1.33	5.00	-0.26	0.21	.70	
	Openness to experience	2,277	6	3.58	0.58	1.33	5.00	-0.15	-0.13	.61	
	Agreeableness	2,277	6	3.65	0.62	1.00	5.00	-0.45	0.28	.67	
	Conscientiousness	2,277	6	3.73	0.61	1.33	5.00	-0.24	-0.10	.77	
	Grit	2,277	8	3.30	0.57	1.50	5.00	0.19	-0.06	.59	
	Curiosity	2,277	7	4.79	0.89	1.43	7.00	-0.20	-0.08	.74	
	Ambition	2,277	5	3.91	0.68	1.00	5.00	-0.48	0.09	.74	
	Outcomes	Educational attainment	1,561	1	8.33	1.81	1.00	11.00	-1.46	1.68	—
		Degree classification	989	1	4.20	0.67	1.00	5.00	-0.62	0.99	—
		University rank	917	1	65.05	37.08	1.00	124.00	-0.06	-1.37	—
		Well-being	1,597	13	11.86	3.95	0.00	16.00	1.06	0.39	.87
Purpose in life		1,620	5	3.53	0.76	1.00	5.00	-0.56	0.10	.82	
Self-control		1,580	6	14.97	3.97	0.00	24.00	-0.44	-0.01	.69	
Volunteering		1,597	5	5.75	3.23	0.00	17.00	0.62	0.14	—	
Behavior problems		1,596	25	9.87	5.59	0.00	34.00	0.77	0.39	.87	
Risk-taking		1,575	6	6.23	3.37	0.00	20.00	0.65	0.36	.63	
Risky sex		1,528	4	4.22	2.66	0.00	11.67	-0.05	-0.79	—	
Aggression		1,575	8	2.44	0.75	1.00	4.88	0.44	-0.30	.65	
Peer victimization		1,453	16	3.06	4.80	0.00	29.00	2.21	5.21	.87	
Bullying		1,451	16	1.92	3.05	0.00	23.00	2.31	6.95	.94	
Antisocial behavior		1,449	15	0.24	0.88	0.00	10.00	5.17	33.29	—	
Conflict with the law		1,445	3	0.04	0.24	0.00	3.00	6.69	49.39	—	
Alcohol use		1,348	10	7.74	4.91	0.00	34.00	1.06	1.94	—	
Cannabis use	694	1	0.89	1.24	0.00	5.00	1.63	2.12	—		

Note. *N* = sample size; *n* = number of items per scale; *SD* = standard deviation; Min = Minimum; Max = Maximum; α = Cronbach's alpha; SES = socioeconomic status.

^a α is not provided for variables that were single-item measures or composite rather than psychometric scale scores. There is no α for IQ as this is a composite of two scales, with α .79 and .82, respectively.

For educational outcomes, personality had weaker effects than family SES and intelligence. However, consistent with previous literature, conscientiousness significantly predicted both educational attainment ($\beta = .081, p = .005$) and degree classification ($\beta = .162, p < .001$). Ambition, but not grit ($\beta = .003, p = .924$) also predicted educational attainment ($\beta = .166, p < .001$). Grit strongly correlated with conscientiousness ($r = .49$) and ambition ($r = .43$; see Figure 1), suggesting that any variance explained by grit may have been accounted for by conscientiousness and ambition.

Additional preregistered analyses are not reported in this article, but are included in this project folder on the OSF (see <https://osf.io/mtn94>).

The Role of Intelligence and Personality in the Association Between Family SES and Emerging Adulthood Outcomes

Our correlations suggested that intelligence, but not personality was significantly related to family SES (Figure 1). Because a significant correlation between predictor and “mediator” was one of our criteria for testing path models (Baron & Kenny, 1986), we did not test if personality traits accounted for the associations between family SES and emerging adulthood outcomes. Because family SES was a significant predictor of five emerging adulthood outcomes (i.e., educational attainment, degree classification, volunteering, behavioral problems, and aggression; Table S1),

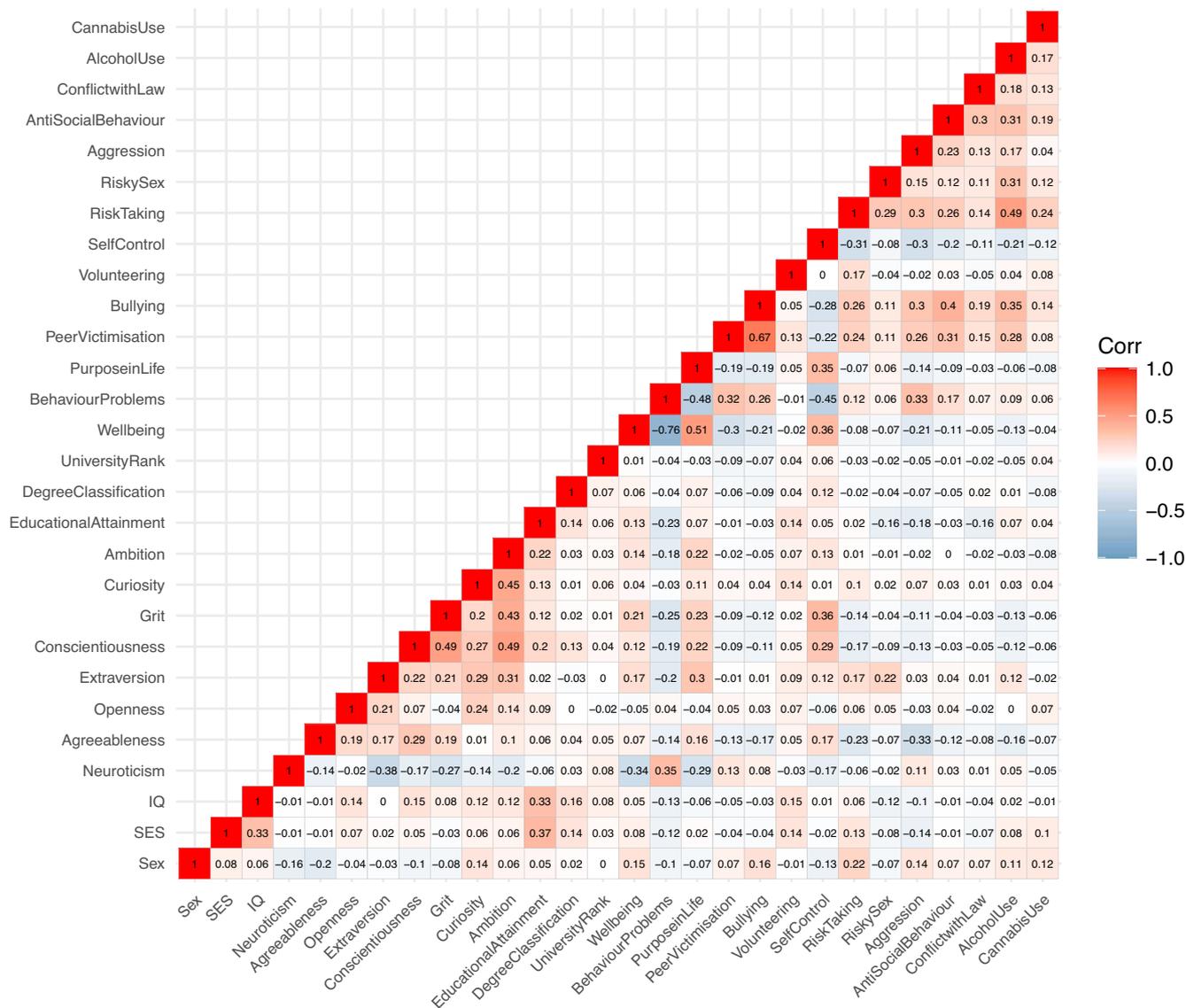
we built path models with family SES as the predictor and intelligence as the “mediator” for each. Table S2 shows the paths for family SES, the family SES \times intelligence paths, and total effects after bootstrapping and corresponding confidence intervals. Figure 3 displays the path model results for each outcome with the standardized regression coefficients and the proportion of the association accounted for by intelligence.

Intelligence partially accounted for the associations between family SES with educational attainment, indirect effect: $\beta = .079$, 95% CI [0.113; 0.183], degree classification, $\beta = .046$, 95% CI [0.014; 0.044], volunteering, $\beta = -.040$, 95% CI [-0.192; -0.071], behavioral problems, $\beta = -.034$, 95% CI [-0.292; -0.085], and aggression, $\beta = -.022$, 95% CI [-0.032; -0.004]. Intelligence explained between 16.35% and 29.09% of respective outcomes' association with intelligence. According to the guidelines by Kenny and Judd (2014), the intelligence's path's effect size for educational attainment was medium (0.108) and small for degree class (0.050), behavioral problems (0.042), volunteering (0.050), aggression (0.033), and sexual risk-taking (0.038).

Intelligence and Personality \times SES

Finally, we tested if intelligence and personality had weaker or stronger effects at higher or lower levels of SES. Table S3 displays the standardized coefficients and R^2 values for each model.

Figure 1
Correlations Between Family SES, Adolescent Intelligence and Personality, and Educational and Social–Emotional Outcomes in Emerging Adulthood



Note. SES = socioeconomic status. See the online article for the color version of this figure.

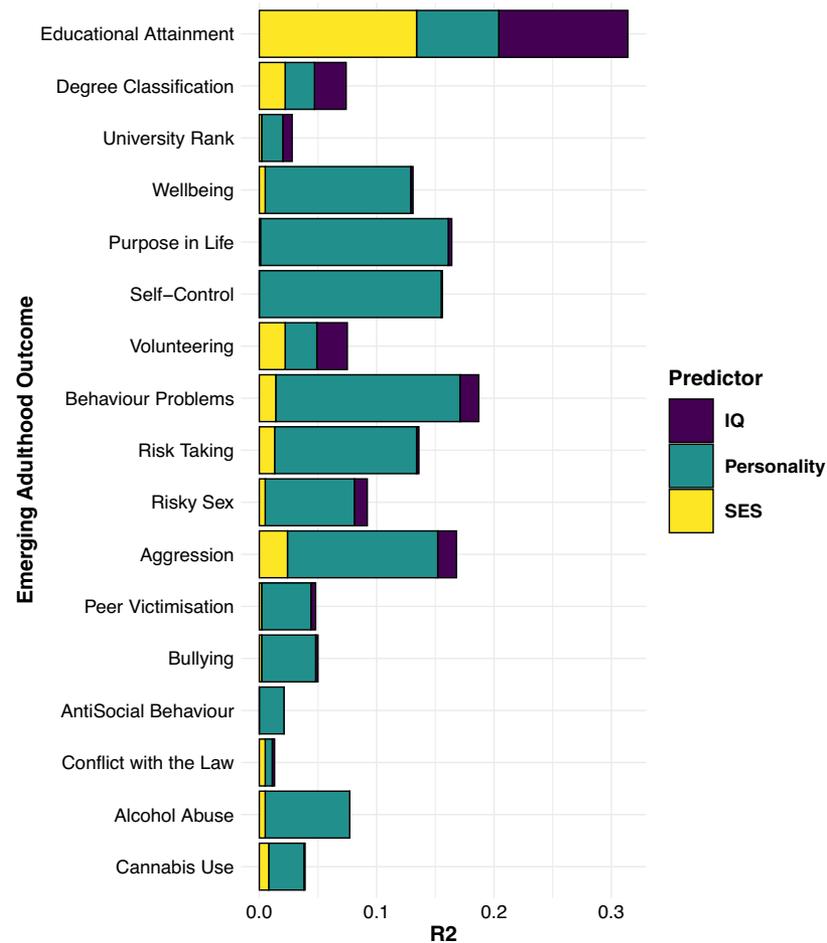
Significant interactions at the Bonferroni corrected p value of .0056 were observed only for educational attainment. Specifically, associations between educational attainment and intelligence ($\beta = -.117, p < .001$), conscientiousness ($\beta = -.142, p < .001$), ambition ($\beta = -.109, p < .001$), and openness ($\beta = -.081, p = .001$) were moderated by SES (Figure 4), such that the individual differences had stronger effects on educational attainment at lower levels of SES, in support of the resource substitution hypothesis (Mirowsky & Ross, 2003). In addition, Curiosity \times SES emerged as a significant interaction in the first twin ($\beta = -.075, p = .003$), but just missed the corrected p value in the second twin ($\beta = -.067, p = .006$). Because of the conservativeness of our p value correction, we cautiously interpret this

interaction as significant. Overall, these interactions of SES with dimensions of individual differences explained small but significant amounts of variance in educational attainment above and beyond their direct effects, including 1.7% for intelligence, 3% for conscientiousness, 1.6% for ambition 0.7% for openness, and 0.4% for curiosity.

Robustness Analyses

The ANOVA tests for comparing our models across two samples of one randomly selected twin per pair were nonsignificant in all cases ($p > .05$). Thus, despite some small differences, our results were comparable and robust across the two twin samples.

Figure 2
R² Values for Intelligence, Personality, and SES for Emerging Adulthood Outcomes



Note. This figure was derived from the independent contributions of each predictor [Model 1 (IQ), 2 (Personality), and 3 (SES)] and does not reflect the extent to which predictor domains share variance. Thus, the total R^2 per emerging adulthood outcome in the figure exceeds the adjusted R^2 value of the respective outcome's Model 4. SES = socioeconomic status. See the online article for the color version of this figure.

Discussion

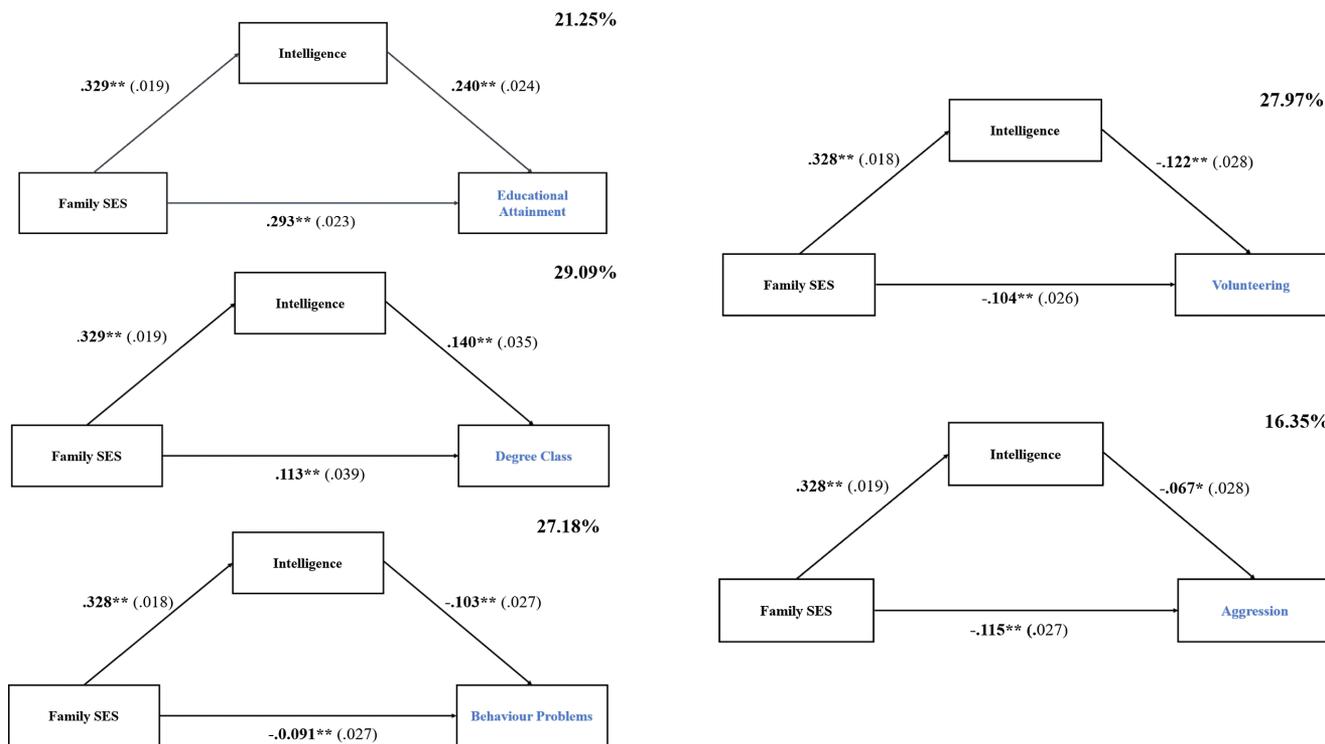
To date, few studies have comprehensively tested the longitudinal prediction of adolescent intelligence and personality traits, and family SES for emerging adulthood outcomes, and even fewer have explored their interplay (e.g., Damian et al., 2015). As a result, the importance of adolescent individual differences for emerging adulthood outcomes, and how these associations may differ across the social divide are not well understood. Our findings from analyses of a longitudinal, U.K.-representative cohort sample make four important contributions to the literature.

First, we showed that individual differences in adolescent intelligence, personality, and family SES can predict outcomes 7 years later in emerging adulthood. This suggests emerging adulthood is at least in part, a continuation of adolescent development, with core individual differences and socioeconomic conditions meaningfully predicting later outcomes. As hypothesized, we

observed that these effects are largely domain specific, such that intelligence and family SES were generally more predictive of educational outcomes, whereas personality was a stronger predictor of social-emotional outcomes. However, we also observed significant cross-domain prediction; for example, intelligence emerged as a significant predictor of behavior problems, aggressive behavior and volunteering, and personality traits, specifically ambition and conscientiousness, also explained significant variance in educational outcomes. Furthermore, when family SES was controlled, conscientiousness was a stronger predictor of degree class (i.e., achievement at university) than intelligence. This confirms our hypothesis and aligns with previous findings that intelligence is less strongly associated with achievement at higher levels of education (Furnham & Chamorro-Premuzic, 2004; Poropat, 2009; Richardson et al., 2012). Finding cross-domain prediction and fluctuations in predictive validity across life and education stages substantiates the importance of studying how individual

Figure 3

Intelligence Accounting for Associations Between Family SES and Educational Attainment, Degree Classification, Volunteering, Behavioral Problems, and Aggression



Note. % refers to the proportion of the SES–outcome relationship accounted for by intelligence. Standard errors are shown in parentheses. SES = socioeconomic status. See the online article for the color version of this figure.
* $p < .05$. ** $p < .01$.

differences in intelligence and personality relate to people’s developmental trajectories (Roberts et al., 2007).

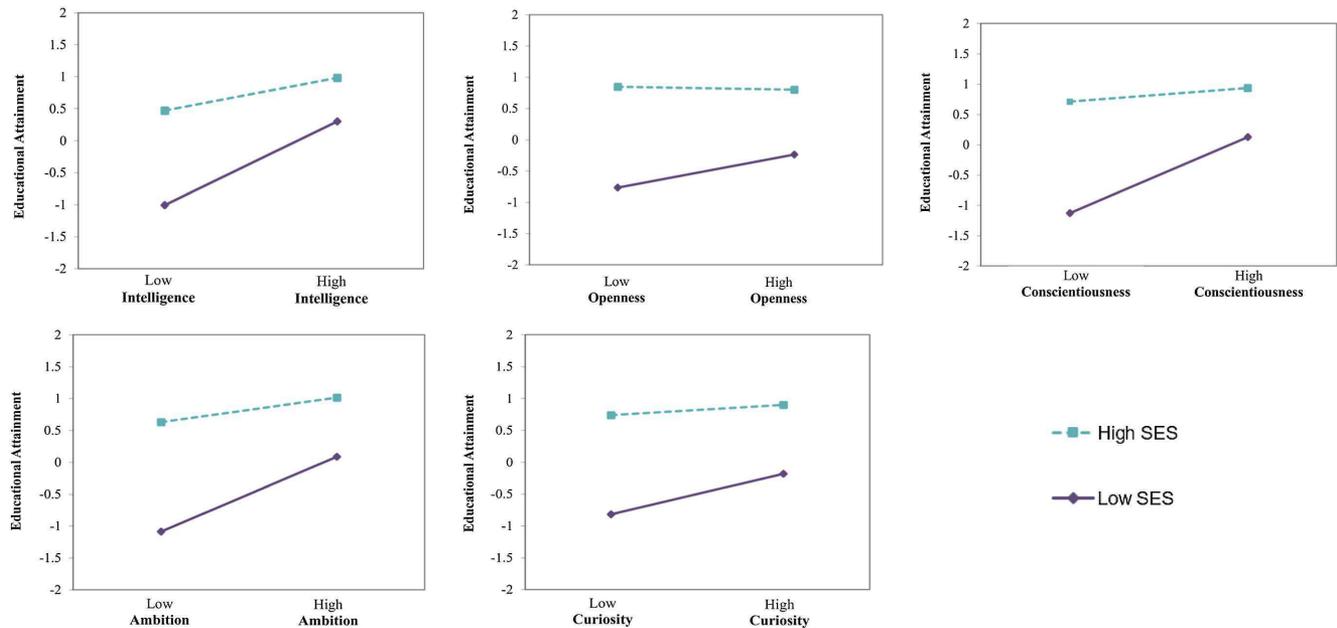
Second, while the majority of variance in emerging adulthood outcomes could not be attributed to intelligence, personality, and family SES, we observed significant, systematic prediction. Together, our predictors accounted for a maximum of 23.8% of the variance in an emerging adulthood outcome, namely, educational attainment, and on average, intelligence, personality, and family SES predicted 9.7% of the variance across all outcomes. While these estimates leave a good amount of variance unaccounted for, they should be recognized as substantial effects in the broader context of psychological science (Götz et al., 2021). Overall, our findings evidence the long-term predictive power of intelligence, personality traits, and family SES for developmental trajectories in emerging adulthood. Because this life phase is characterized by instability, exploration, and possibility (Arnett, 2000), some of its observable variance may be due to new, emerging factors and influences, in addition to being partly attributable to stable adolescent individual differences. The notion of new, life-phase specific influences suggests that interventions that target emerging adults directly could be effective. By contrast, finding developmental continuity recommends intervening early, perhaps even prior to adolescence, to nudge individuals onto promising developmental paths. A key area for future research is to develop and test emerging

adulthood interventions and identify the ages when they achieve maximum returns. That said, it is also possible that psychological domains in adolescence other than intelligence and personality better predict emerging adulthood outcomes. For example, adolescent mental health is thought to have strong influence on later emotional adjustment (Benjet et al., 2016; McGee et al., 2000) and on establishing and maintaining social relationships (Geoffroy et al., 2018; Newcomb-Anjo et al., 2017).

The third contribution of our study pertains to the interplay between family background and dimensions of individual differences in their prediction of emerging adulthood. Confirming previous findings (Fergusson et al., 2008; von Stumm, 2017), we showed that intelligence partly accounted for the relation between family SES and education outcomes. In addition, we observed here for the first time that intelligence also partly explained the association between family SES and social–emotional outcomes in emerging adulthood, specifically for behavior problems, aggression, and volunteering. This finding substantiates that family SES and intelligence are not only important predictors of education, but their interplay also relates to social–emotional outcomes. Indeed, intelligence explained between 16.4% and 29.1% of the relations between family SES and emerging adulthood outcomes across domains (Figure 3). Our findings also suggest that other paths or “mediators” are likely to affect the association between family SES and emerging

Figure 4

Family SES as Moderator of the Relation Between Educational Attainment With Intelligence, Conscientiousness, Ambition, Openness, and Curiosity



Note. The block purple (dark gray) line represents the low SES group, and the broken blue (light gray) line represents the high SES group. SES = socioeconomic status. See the online article for the color version of this figure.

adulthood outcomes, because intelligence only accounted for some of the relation, and because we did not test other mediators. In our analyses, no personality traits met the criteria for testing if they accounted for any of the association between family SES and educational and social-emotional outcomes in emerging adulthood. This null-finding contradicted our hypotheses and contrasts with a prior study that concluded that neuroticism partially accounted for the relation between family SES and achievement (Shanahan et al., 2014). Yet, it aligns with the wider, previous literature that reported weak and inconsistent links between SES and personality traits (Flensburg-Madsen & Mortensen, 2014; Menardo et al., 2017). We, therefore, conclude that personality traits are unlikely to account for a significant proportion of the association between family SES and emerging adulthood outcomes.

Our fourth contribution also follows from our analyses of the interplay between family SES and individual differences dimensions in the prediction of emerging adulthood outcomes. Specifically, we found that family SES moderated the prediction of intelligence, conscientiousness, ambition, openness, and curiosity for educational attainment, in the way that these traits were more strongly associated with educational attainment at low than at high levels of family SES. These results support the idea of resource substitution, or compensatory effects, for the five traits (Mirowsky & Ross, 2003), with the interaction terms accounting for significant variance above and beyond the predictors' direct effects. It appears, therefore, that certain personality traits matter less for people from high SES backgrounds for their educational attainment in emerging adulthood than for those from less privileged family homes. This pattern of moderation results aligns with previous findings which

also observed compensatory effects by personality traits, specifically the Big Five (Damian et al., 2015). For intelligence, prior studies found evidence for the Matthew effect, whereby the benefits of family SES and intelligence were greater than their additive effect (i.e., positive interaction; Damian et al., 2015; Merton, 1968).

The discrepancy in findings regarding the intelligence-SES interaction may be due to several reasons. For one, the U.K., where our sample is from, and USA, where the sample in the study by Damian and colleagues was recruited, differ in their socioeconomic spectrum, with the USA exhibiting greater social inequality than the U.K. (Blundell et al., 2017; Tucker-Drob & Bates, 2016). For the other, our sample was born in the mid-1990s, while the prior study analyzed data from a cohort who attended high school in 1960 and thus, were born sometime before 1950. In addition to national socioeconomic differences, the samples therefore experienced very different sociopolitical climates, including different education systems and vastly different enrolment rates for higher education (Department for Education, 2020; Office for National Statistics, 2016). It is possible that for emerging adults of the millennial generation, intelligence can help compensate in educational attainment for family background disadvantage, as we observed here, rather than serving as an accelerator for background privilege.

Overall, we found that the interaction effects were too small to fully compensate for family background disadvantage in educational attainment. The largest effect size—the interaction term for conscientiousness—predicted 3% of the variance in educational attainment, while the additive direct effects of family SES and conscientiousness accounted for 17.5%. Although it remains speculative if fostering conscientiousness or any of the other five

interactive traits is possible and effective for ameliorating family background inequality in educational attainment, several recent studies have proposed that personality traits make excellent intervention targets (e.g., Richmond-Rakerd et al., 2021; Roberts et al., 2007; Stieger et al., 2021). Thus, future research should explore the potential advantages of systematically altering personality traits to benefit emerging adults' outcomes.

Strengths and Limitations

Our study has some notable strengths. The use of a large scale, longitudinal sample that was representative of the U.K. population allowed us to empirically test the prediction of adolescent intelligence and personality, and family SES for educational and social-emotional outcomes in emerging adulthood. Assessing a broad range of measures also helped to integrate previously fragmented literature.

At the same time, our study suffers from several limitations. First, many of the studied constructs, including personality, educational, and social-emotional outcomes, were assessed via self-report measures. Although some of these self-report data have been validated against information from other sources, the degree to which they and any analysis results pertaining to them might be affected by subjective biases is unknown. Likewise, it is impossible to disentangle the extent to which the observed associations are due to common measurement methods in the present study. Some studies have shown that self-reported and "other-rated" personality assessments differ (Ludeke et al., 2014; Watson & Humrichouse, 2006), suggesting that our findings may vary across "other rated" and self-reported personality assessments.

Second, although we analyzed a broad range of outcomes in emerging adulthood, some of the corresponding assessments lacked specificity or did not capture the intended construct well. For example, cannabis use was assessed with a single item ("In the last 12 months, how often have you used cannabis?") that did not allow differentiating degrees of usage or capturing problematic use or addiction. Another example was university rank, which correlated only weakly with other assessments of educational outcomes, such as attainment, degree class, and school leaving grades.

Third, our study included several emerging adulthood outcomes that were not particularly well predicted by intelligence, personality, and family SES. Besides university rank, just 1.2% and 2.1% of the variance in antisocial behavior and conflict with the law, respectively, were accounted for by the three predictors, which is likely to be due to the outcomes' skewed distribution (see Table 1). However, individual differences in dimensions other than intelligence and personality, for example, mental health and motivation, may have better explained variance in these and other emerging adulthood outcomes. Future research should continue to explore a broader scope of predictors of adjustment in emerging adulthood.

Fourth, we considered two important pillars of emerging adulthood—educational and social-emotional adjustment—but our sample was too young to provide data on career development, which is also key to the transition to adulthood (Arnett, 2004). Thus, our study could not shed light on the role of adolescent intelligence and personality and early life SES for emerging adults' paths into the world of work, including different professional roles, income, and job satisfaction.

Finally, we controlled for gender in our analyses rather than modeling its interplay with the other study variables in the prediction of emerging adulthood outcomes. We made this decision because explorations of gender were beyond the scope of the present study, but we recognize that gender differences exist in both educational outcomes and social-emotional adjustment during emerging adulthood (Conley et al., 2020; Foster et al., 2018; Howard et al., 2010; Richardson et al., 2020) and are important to explore. For example, one study showed that women exhibit poorer well-being compared to men in emerging adulthood, but men experience poorer social support for their psychological distress (Conley et al., 2020). Future studies could explore if these gender differences in outcomes are driven by interactions of gender with intelligence and personality.

Conclusions

We showed here that adolescent intelligence, personality, and family SES significantly and independently of each other predict educational and social-emotional outcomes in emerging adulthood. We observed modest developmental continuity between adolescence and emerging adulthood, suggesting opportunities for effective interventions during this life period to improve young people's maturation processes. We also confirmed that intelligence accounted for some of the associations between family SES and a range of emerging adulthood outcomes. In contrast, personality traits did not explain these associations, supporting the notion that personality development is largely independent of family background. Finally, we identified five traits, including intelligence, conscientiousness, ambition, openness, and curiosity, that helped compensating for family background disadvantages in educational attainment. If these associations prove to be causal, intervention efforts that target personality traits could be developed and implemented to reduce family background inequality in education.

Societal changes, including the expansion of higher education, the increasing volatility of the labor market, and the erosion of traditional family roles, have amplified the stressors and pressures that emerging adults face. Yet, emerging adults continue to carry the responsibility and promise of being the next generation of earners and parents that are the core pillars of our societies. Understanding the psychological characteristics and structural factors that enable and hinder emerging adults to become resilient and productive members of society is therefore of pivotal importance.

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