

**Accounting for the Association Between Socioeconomic Status and Youth Political
Participation: A Twin Family Study**

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Abstract

Political participation (PP) has been found to be associated with socioeconomic status (SES) indicators, most strongly with educational attainment. At the same time, previous research has been inconclusive regarding potentially biasing effects of personality and cognitive characteristics on this association. In the present study, we investigated the association between different forms of youth PP and attained SES, taking youth's and parents' individual characteristics into account. We used data from 983 German twin families with same-sex twin pairs of emerging adults (aged 21 to 25) that provided information on electoral, nonelectoral individual and collective political participation as well as on youth's and their parents relevant personality and cognitive characteristics. After adjusting for youth's and parents' individual characteristics, regression analyses showed educational attainment and household income to be solely significantly associated with emerging adults' electoral political participation. Genetically informative analyses revealed confoundedness due to shared environmental factors for electoral PP and due to genetic factors for individual and collective PP. Depending on the form of PP, the covariance between attained SES indicators and youth's PP mostly or fully overlapped with variance in political interest, general cognitive ability, and/or openness to experience. Findings are discussed against the backdrop of genotype-environment interplay.

Keywords: political participation, socioeconomic status, emerging adults, twin family study, personality, family characteristics

Highlights

- Attained socioeconomic status (SES) does not (quasi-)cause emerging adults' political participation.
- Irrespective of the participatory form, individual differences in political interest partially or fully account for the association between attained SES and emerging adults' political participation. Interventions aimed at increasing political interest may thus counteract political inequality.
- Environmental factors that affect within-family similarity in general cognitive ability and political interest mediate the covariance of educational attainment and household income with emerging adults' electoral political participation.
- Genetic factors that contribute to differences in general cognitive ability, political interest, and openness to experience mediate the association of educational attainment and emerging adults' individual political participation.
- Genetic factors that contribute to differences in political interest mediate the association of educational attainment and emerging adults' collective political participation.

Accounting for the Association Between Socioeconomic Status and Youth Political Participation: A Twin Family Study

Socioeconomic status (SES) has been found to affect the political participation of emerging adults across all forms of political participation – traditional (e.g. civic, electoral and political party-related) as well as novel (e.g., digital, lifestyle; Dalton, 2017; Gaby, 2017; Pacheco & Plutzer, 2008; Verba et al., 1995) and across cultures (Castillo et al., 2014; Esser & de Vreese, 2007; van Deth et al., 2007), with people of higher SES being significantly more likely to engage in politics than those of lower SES. Since the needs and demands of less politically vocal people may be overlooked, early-stage nonparticipation of less socioeconomically privileged people may increase social disparities (see also Verba et al., 2003). These may accumulate throughout the life cycle, as young people's political participation predicts their later involvement (or lack thereof) in adulthood (Schlozman et al., 2012). Thus, youth nonparticipation may pose a vicious cycle of systematic disadvantages that ultimately subverts the foundations of democracy (Dalton, 2017).

The relationship between SES and political participation rests on solid empirical foundations, but there is less empirical evidence about the extent to which third variables may account for this association. Recent work has argued that heritable individual characteristics, such as extraversion and intelligence (e.g., Dawes et al., 2014), may lead to a spurious association between socioeconomic factors and political participation (Aarøe et al., 2020). Factors of the family environment, such as parents' individual characteristics and behavior, may also partially account for the association (e.g., Kornadt et al., 2018). Yet, little research has been conducted to comprehensively integrate findings related to SES, individual characteristics, and family environment. This study aims to shed light on the matter by considering a variety of key variables and using genetically informed data. We investigated the links between socioeconomic indicators (i.e., educational attainment, income, occupational status) and different forms of political participation in emerging adults (age 21-25). First, we aimed to identify the specific factors that might confound this association by considering a broad number of previously linked

personality and cognitive characteristics of emerging adults and their parents. Second, we used twin family data to uncover the extent of confounding based on genetic and shared environmental effects in general, taking the confounders detected in the first analytical step in addition to potentially unmeasured factors into account.

Socioeconomic Status and Youth Political Participation

Irrespective of age, political participation has been consistently positively associated with SES indicators, particularly with educational attainment (Akee et al., 2020; Gallego, 2015; Schäfer, 2012; Schlozman et al., 2010) – a foundational idea behind the Civic Voluntarism Model, the leading theoretical framework explaining this association (Verba et al., 1995). According to this model, certain resources (time, money, civic skills), individual (political) characteristics and, to a lesser extent, recruitment networks affect individual political activity. The unequal distribution of money and civic skills among socioeconomic groups accounts for the association between SES and political participation (Brady et al., 1995).

Youth political participation - like political participation in general - has evolved over time (Sloam, 2014). At first perceived as disengagement (e.g., Putnam, 2000), youth's declining engagement in traditional, institutionalized forms of political participation was understood to reflect young people's increasingly idiosyncratic and diversified approach to politics and political participation (Cammaerts et al., 2014; Fisher, 2012; O'Toole et al., 2003). Traditional forms of political participation, such as voting and party membership, have been accompanied by youth engagement through social movements, signing petitions, volunteerism, political consumerism, and, more recently, political social media use (Earl et al., 2017; Theocharis & van Deth, 2018; Zukin et al., 2006). These forms reflect political participation by meeting various criteria that researchers agree on: they are voluntary activities of citizens that may concern or target government and politics, and which might also be aimed at addressing social issues and community problems (Theocharis & van Deth, 2018). Interestingly, while some scholars have expressed optimism about the amelioration of SES-based participatory inequalities after the emergence of social media due to the extremely low cost and resources required for

participation in politics through these tools (Theocharis, 2015; Xenos et al., 2014), the limited existing research on social media and youth participatory inequalities has not yet supported this assumption (Keating & Melis, 2017).

Past findings have been inconsistent regarding whether SES predicts political participation or whether, for instance, it is merely a 'proxy' for individual and social characteristics (Brady et al., 1995; Gerber et al., 2011; Hillygus, 2005; Kam & Palmer, 2011). Most notably, the association between education and political participation has been controversially suggested to be spurious, underlying individual (cognitive and personality) characteristics and pre-adult socialization (Berinsky & Lenz, 2011; Persson, 2015). However, past studies reported independent significant effects of individual characteristics and SES (Furnham & Cheng, 2019) as well as a (partial) mediation by either individual characteristics (Cohen et al., 2001) or SES (Bekkers, 2005).

Uncovering Confounding due to Individual Characteristics

Definite evidence concerning the association of interest has been likely impeded due to the predominant but restrictive focus on electoral participation, diverse measures of SES, and somewhat fragmentary investigations of individual and social characteristics. Moreover, the prevalent cross-sectional research does not allow for causal inference. This may be partially overcome through genetically informed analyses.

Conceptually an environmental variable, the socioeconomic background would presumably have a direct causal environmental effect on youth political participation. However, genetic factors contribute to variance in attained SES (Heath et al., 1985; Lichtenstein et al., 1992; Liu, 2019; Taubman, 1976). Socioeconomic differences may thus be affected by variance in heritable predispositions, both directly through effects of individual characteristics as well as indirectly through gene-environment interplay within, for instance, youth's family environment (see below). Thus, genetic and environmental influences may explain the association between SES and youth political participation. Indeed, SES and political participation were found to share genetic variance (Dinesen et al., 2016).

By decomposing the covariance between two variables into genetic and environmental components, twin family designs can provide insight into whether SES effectively affects youth political participation or whether third variables confound the association (e.g., Turkheimer et al., 2014). Twin family designs allow us to test for confoundedness due to genetic factors – as mediated through heritable individual characteristics (see Figure 1A) – and environmental factors *shared* within families. Specifically, under the assumption that mono- and dizygotic twins equally experience the environment (e.g., are not differently treated by their parents due to their zygosity), classic twin designs help disentangle genetic effects from environmental effects by comparing differences within and between twin pairs. Beyond genetic effects, these analyses allow for the differentiation between environmental influences that are shared within families (i.e., between twin siblings) and environmental influences that are unique for each individual (i.e., each twin). Shared environmental influences include cultural and family environment (e.g., parenting style), household (e.g., family socioeconomic background), and neighborhood. Unique environmental influences include certain life experiences, different friends, and different work environments. In the following, we outline relevant individual characteristics and how they – on their own as well as in conjunction with the family environment – could confound the association of interest.

<Insert Figure 1 here.>

Individual characteristics that past work has shown to be consistently associated with political participation (and SES) include political interest (Soler-i-Martí, 2015), general cognitive ability (Deary et al., 2008; Strenze, 2007), extraversion and openness to experience (Denny & Doyle, 2008; Mondak & Halperin, 2008), interpersonal and political trust (Hooghe & Marien, 2013), and political self-efficacy (Finkel, 1985; Littvay et al., 2011; Vecchione & Caprara, 2009). Genetically informed studies (of mostly adult samples) showed a genetic interwovenness of these individual characteristics with SES (Malanchini et al., 2020; Möttus et al., 2017) and political participation (Dawes et al., 2014, 2015). For example, Aarøe et al. (2020) reported a

substantial genetic correlation of voter turnout with educational attainment ($r_g=.76-.95$) and intelligence test performance ($r_g=.69-.78$).

Political interest and general cognitive ability have been argued to lead to political participation due to the information processing it requires. Specifically, political interest leads to a higher attentiveness to and engagement with political information, and cognitive ability facilitates the comprehension of this information (Luskin, 1990). Feeling personally (politically) effective, as reflected through self-efficacy beliefs, also has an influence on whether individuals are politically active (Finkel, 1985). Regarding broad personality traits as defined by the Five-Factor Model (McCrae & Costa, 2008), extraversion and openness to experience are the overall most consistently found predictors of PP. Seeking interpersonal interactions and being active and assertive – the inherent facets of extraversion – can lead to a higher inclination for PP, particularly for social forms of PP (Huber et al., 2021). Openness to experience may affect PP due to the curiosity and intellectual thirst for (political) knowledge it entails (Gerber et al., 2011). Moreover, openness to experience and extraversion may indirectly affect PP through political interest, political discussion, and self-efficacy beliefs (Gallego & Oberski, 2012). Finally, researchers have discussed that low interpersonal and political trust can either lead to less political participation – due to a required basic satisfaction with and trust in the political process – or to more noninstitutionalized (elite-challenging) forms of political participation (Hooghe & Marien, 2013; Levi & Stoker, 2000).

Genetic Confounding Mediated via Youth's Family Environment

Parents' individual characteristics and behavior have been linked to their offspring's political participation (Beck & Jennings, 1982; Burden et al., 2020; Gidengil et al., 2016). Specifically, parental political involvement increases the likelihood of the offspring's political involvement in later life (Andolina et al., 2003; McFarland & Thomas, 2006). Researchers attributed this association to direct effects through social learning mechanisms (Bandura, 1977) and the mediation effects of political interest, family political discussions, and family SES (Quintelier, 2015b). Yet, this could also reflect genotype-environment interplay. Since parents

provide both the genetic make-up and rearing environment, parental effects may reflect *passive genotype-environment correlation* (see Figure 1B; Scarr & McCartney, 1983). In other words, parents facilitate certain dispositions of their offspring by shaping the offspring's environment in accordance with their own dispositions. For example, politically active parents may be more likely to lead political discussions with their offspring and encourage them to be politically active (Kornadt et al., 2018). It has to be taken into account that parents' behavior may be substantially interlinked with their own attained SES. The effects of socioeconomic background and individual predisposition are thus potentially already highly intertwined in parents' behavior (see Figure 1C). In addition, environmental responses to observable genetically influenced individual characteristics, known also as *evocative genotype-environment correlation*, may account for parents reinforcing their offspring's political participation (Cesarini et al., 2014). For example, parents may perceive their offspring's political interest and may consequently suggest political activities within the community.

Irrespective of the underlying mechanisms, it is worthwhile to consider attributes of the family environment. Using a discordant sibling design, Gidengil et al. (2019) found that the effect of education on voting diminished after accounting for parents' education and voting as well as other shared unobserved family influences.

Notwithstanding genetic interrelatedness, the effect of the socioeconomic differences on differences in youth political participation may effectively be environmental. In this context, the moderation of genetic effects by the environmental setting, a form of *genotype \times environment interaction*, may be of importance. SES may moderate the effect of individual characteristics, such as general cognitive ability, on political participation (Tucker-Drob & Bates, 2016; Zavala et al., 2018). Similarly, past studies suggested that family SES moderate parents' effects on their offspring's political participation (Conger et al., 2010). Specifically, SES may affect the family climate, which in turn affects relevant parent-offspring interactions and activities. The main puzzle that emerges from past work, therefore, is how can an "effectively" environmental effect

of SES on political participation be empirically disentangled from confounding due to genetic and within-family shared environmental factors.

The Present Study

The aim of the present study was to gain insight into the association between social inequality and youth political participation under the consideration of individual and social characteristics. Specifically, we ask whether the political participation of emerging adults (aged 21 to 25 years) is affected by their attained socioeconomic status, and whether this association is attributable to their or their parents' individual characteristics. Because observed individual characteristics may introduce potential confounding, we assess the extent to which genetic and environmental factors contribute to this confounding. Conversely, in situations where observed individual characteristics do not pose a confounding issue, we examine whether the association is influenced by other unobserved heritable traits and/or specific environmental factors shared among twin siblings.

An important measurement consideration in the study of SES and political participation is that SES indicators are often combined into a composite score. However, given the multifarious resources they entail, merging them may conceal specific associations, especially for young people, for whom these indicators may not be as strongly intercorrelated (e.g., educational attainment and income). To that effect, SES indicators are not interchangeable, but rather comprehensive in the understanding of the social standing of a person (American Psychological Association, Task Force on Socioeconomic Status, 2007).

Literature on this subject has mainly focused on adult participation, hampering the formation of hypotheses on youth political participation. Based on previous findings, consistent with past work we expected to find positive associations between educational attainment, household income, and occupational status and youth political participation. We expected youth political participation to be positively associated with youth political interest, general cognitive ability, interpersonal trust, self-efficacy beliefs, openness to experience, and extraversion. We decided not to formulate specific confounding hypotheses and keep the analyses exploratory.

Data and Methodology

Data

TwinLife is an ongoing cross-sequential longitudinal German twin family study comprising 4000 twin families (Diewald et al., 2023; Rohm et al., 2023). The study relies on mixed-mode surveys and covers six broad domains of social inequality and a variety of demographic, personality, and environmental variables. We considered data from one cohort from the first wave of data collection, which started in October 2014 and was completed in April 2016. A total of 3583 participants from 983 families provided data relevant for the present study (See **Table 1** for sample descriptive statistics).

Measures

Political Participation and Its Latent Structure

Participants answered whether they had voted in the last federal election and whether they would vote if there was a federal election next Sunday. To the best of our knowledge, the study goes beyond previous work on the topic and, besides electoral participation, it considers a larger repertoire of participatory acts including several high- and low-cost political activities that fall within broader classifications of political participation into party-related, protest, boycotting, and civic modes of engagement (Teorell et al., 2006). Specifically, participants indicated on a dichotomous scale (0 = *No*, 1 = *Yes*) whether they had engaged in the following political activities within the past 12 months: (1) attended a political meeting, discussion event, or a demonstration (henceforth *political meeting*), (2) participated in an online petition or a signature collection (*petition*), and (3) boycotted a company or products for political, ethical, or ecological reasons (*boycott*). They further indicated on a polytomous scale (0 = *never*, 1 = *less than once a month*, 2 = *every month*, 3 = *every week*) how often they were active in (4) a political organization, party, or citizens' initiative (*political organization*), (5) a trade union, occupational association, or student council (*occupational organization*), and (6) a volunteer fire department, the German Life Saving Association, the Federal Agency for Technical Relief or the like (*civil*

protection organization). Supplement A comprises the sample's frequency of and correlations between these forms of political participation.

To identify the latent factors of political participation (PP), we ran two-parameter logistic models based on the item response theory paradigm. We excluded the civil protection organization and occupational organization items as they showed a low discrimination ($a = 0.23$ and 0.80) and a high difficulty ($b_1 = 12.91$ and 3.48). Model comparisons using Vuong's approach (Schneider et al., 2020; Vuong, 1989) suggested that a three-factor model solution is superior to other solutions, with that model representing *electoral political participation* (voting), nonelectoral *individual* forms of *political participation* (petition, boycott) and *collective* forms of *political participation* (political meeting, political organization). We computed (ordinal) sum scores to allow for a straightforward interpretation. Details on item characteristics and model analyses are reported in Supplement D. Due to the low frequency of a score of three or four for collective political participation ($n \leq 22$), we subsumed these under a score of two. See Figure D2 for the distribution of political participation scores for each dimension and Table D3 for the correlations between the forms of PP and non-transformed SES indicators.

Socioeconomic Status

We considered attained educational level, household income, and occupational status as socioeconomic indices. In addition, following the Civic Voluntarism Model (Verba et al., 1995), we considered emerging adults' working hours. Supplement B includes descriptive statistics of and correlations between these variables.

Educational attainment was operationalized combining the indicated highest school-leaving qualification (1 = *left school without school-leaving certificate* to 5 = *university entrance level/Abitur*) with an attained university (of applied sciences) degree (6). Monthly net equivalent household income was operationalized using the reported current total income of all household members based on the OECD-modified scale (see <https://www.oecd.org/economy/growth/OECD-Note-EquivalenceScales.pdf>). Occupational status was operationalized with the Standard International Occupational Prestige Scale

(Treiman, 1977) based on the reported current job. The current job was classified following the 2008 International Standard Classification of Occupations (International Labour Office, 2012).

Income and occupational status were z-standardized to facilitate interpretation. In addition, to identify incremental validity, we computed residualized scores, partialling out shared variance of income with educational attainment and of occupational status with both educational attainment and income.

To assess weekly working hours, participants indicated the number of hours they generally work per week including overtime. We specified zero working hours for participants indicating to be not gainfully employed and who had not responded to this item due to the survey design.

Cognitive and Personality Characteristics

We considered general cognitive ability, political interest, self-efficacy beliefs, interpersonal trust, openness to experience, and extraversion (see Table 2 for an overview of the used measures and their reliability ranges). Supplement C presents the descriptive statistics, reliability coefficients, and intercorrelations of the characteristics. All analyses were conducted in R. See Supplement A for details on the software, including R packages and versions.

Strategy for Handling Missing Data

Considering that missing data can be associated with observed or unobserved data (Graham, 2009), it is pivotal to apply appropriate statistical techniques to avoid biased results. We provide a detailed explanation of how we deployed multiple imputation (Rubin, 1987) in Supplement E.

Analytical Strategy

We chose a two-step approach to answer our research questions. Our aim was not just to test for confounding of the covariation of attained SES and youth PP due to genetic and environmental factors, but to shed light onto the specific individual and social factors responsible for the confounding. Yet, to keep genetically informative analyses slim, we first ran regression analyses that allowed to pre-select confounding variables. If variables in the

regression analyses were found to significantly confound the association of interest, we subsequently included these in genetically informative analyses to uncover the specific pathways of confounding.

Multiple Logistic Regression Analyses

We first ran multiple proportional odds logistic regression analyses. These served (a) to assess the effect of SES on youth PP adjusted for variables that have been discussed and empirically found to be of importance and (b) to find potentially confounding variables for the follow-up genetically informed analyses in a parsimonious manner. To achieve both goals, we followed existing recommendations in the literature (Royston & Sauerbrei, 2008) by combining an initial variable selection procedure based on subject-matter knowledge with a subsequent data-driven variable selection strategy. The initial set of variables comprised attained SES, emerging adults' working hours, and emerging adults' and their parents' individual characteristics, namely general cognitive ability, political interest, self-efficacy, interpersonal trust, openness to experience, and extraversion. To provide insight into the association of interest itself, we ran regression analyses with SES as the sole predictors beforehand.

We chose the *augmented backward elimination* (ABE) algorithm since it is more sensitive regarding confounder inclusion compared to other algorithms (Dunkler et al., 2014). We conducted the regression analyses for both twins of a pair separately and cross-validated the algorithm's steps and criteria across them. We started with a model including the full set of pre-selected variables and stepwise excluded bundles of three variables from the model. The order of variable exclusion followed the variables' p -values, with variables with the highest p -values across both twins excluded first. After the exclusion of each variable bundle, we evaluated the change in the regression coefficients of the main predictors, i.e., attained SES indicators, across both twins. The variable bundle remained excluded only if the absolute standardized change in estimate of the attained SES indicators was lower than $\tau = .05$ across both twins. Subsequently, the next variable bundle was excluded, and its exclusion was evaluated accordingly. Attained SES indicators as the main predictors were never excluded. This

was repeated until the exclusion of every variable above our predefined significance cut-off ($\alpha = .10$) was evaluated using the change-in-estimate criterion ($\tau = .05$). We considered effects in the final model to be meaningful if found to be statistically significant ($p < .05$) across both twins (see Dunkler et al. (2014) for more details on the algorithm procedure and its selection criteria).

Genetically Informative Analyses

Twin models allow estimating the contributions of genetic and environmental sources to variances of and the covariance between multiple characteristics. The classic twin design compares MZ and DZ twin correlations under the assumption that both groups underlie equal environments. Since MZ and DZ twins differ in their genetic relatedness, between-pair correlation differences are attributable to additive genetic (A) and non-additive genetic factors (here: *dominance*; D). Both genetic factors are fully shared among MZ twins since they are genetically identical. DZ twins share on average 50% of segregating additive and 25% of segregating non-additive genetic factors. In contrast, comparable correlations between MZ and DZ twin pairs suggest contributions from environmental factors that are fully shared by twin siblings brought up together (C). MZ within-pair differences suggest unique environmental effects (E ; including measurement error). Similarly, the comparison of cross-trait cross-twin correlations (e.g., the MZ and DZ twin correlations between the educational attainment of a twin and political participation of their co-twin) inform about the sources of the association between investigated traits.

Since twin siblings raised together are matched for within-family confounds, twin models can also be used as quasi-experimental tests (Turkheimer et al., 2014.). If twin differences in an exposure (e.g., attained SES) are associated with twin differences in an outcome (e.g., political participation), this can be regarded as a quasi-causal effect (assuming the absence of other effects contributing to twin differences). If an association is attributable to genetic and/or shared environmental effects, it is confounded due to other factors.

First, we estimated the most parsimonious univariate model for each form of PP using Akaike weights (Wagenmakers & Farrell, 2004). Akaike weights are transformed Akaike

information criterion values that can be interpreted as conditional probabilities of a set of competitive models. We compared models that differed regarding the included variance components, namely a model including an additive genetic (*A*), shared environmental (*C*), and unique environmental component (*E*; i.e., an ACE model), a model estimating a non-additive genetic (*D*) component instead of shared environmental component (i.e., an ADE model), and more parsimonious models (i.e., CE/DE, AE, and E model). Subsequently, we estimated multivariate Cholesky decomposition models considering the same variance components as found for the univariate models and including significant predictors found in the regression analyses. A Cholesky decomposition model equally enables to estimate three sources of (co-)variance (*A*, either *C* or *D*, and *E*; Posthuma, 2009). These models would reveal to what extent the confounding follows genetic and/or shared environmental pathways – both shared with significant individual characteristics and due to unobserved factors – or whether the association is quasi-causal, as shown through the unique environmental pathway (see Figure 1D).

Classic twin designs assume the absence of genotype-environment interplay (see the introduction for some examples) and assortative mating. Assortative mating refers to the phenomenon that human beings tend to have sexual partners who are similar to them regarding certain phenotypes (i.e., observable characteristics). Among others, a potential underlying mechanism is a genetically driven active assortment based on mate choice, which would lead to a higher genetic similarity of the offspring (and other first-degree relatives) than the assumed shared 50% of segregating genes on average (except for monozygotic twins that are genetically identical). Since dizygotic twin pairs are compared to monozygotic twin pairs in twin studies, not accounting for assortative mating may lead to skewed estimates of genetic and environmental contributions to the trait covariance. To avoid this, we corrected the genetic correlation of dizygotic twins based on the heritability and parents' correlations of PP (i.e., spouse similarities; for details on the correction for assortative mating, see Supplement G).

Results

Multiple Logistic Regression Analyses

In a model containing only SES indicators, we found educational attainment to positively predict all three forms of youth PP (see Table 3). Household income showed incremental validity beyond educational attainment regarding electoral PP.

Following the model selection algorithm, the consideration of youth's and their parents' individual characteristics showed youth's political interest to positively predict all forms of PP, youth's general cognitive ability to positively predict electoral and individual PP, and youth's openness and maternal political interest to positively predict individual PP. Interpersonal trust significantly predicted collective PP for one twin subsample. The adjustment for these variables led to a significant decrease in impact of the significant SES indicators for electoral PP and to nonsignificant effects – for either one or both twins – of educational attainment on individual and collective PP. See Supplement F for unstandardized model results.

Genetically Informative Analyses

We first inspected whether the association between SES and electoral and individual PP was confounded by unobserved variables, and added the significant predictors of the regression analyses in a second step to investigate potential pathways of confounding and variance proportions shared with PP. Univariate model comparisons suggested an ACE model for electoral PP, an AE model for individual, and an ADE model for collective PP (see Supplement G). Due to this, we did not include mother's political interest in the analyses regarding individual PP, as this would be estimated as a shared environmental (*C*) effect.

We found the covariance between educational attainment and household income and electoral PP to be confounded by shared environmental factors which explained half of the variance in electoral PP (see Figure 2). Upon including general cognitive ability and political interest, the shared environmental variance previously common with educational attainment and income was fully shared with general cognitive ability (40%) and political interest (14%). Thus, factors contributing to the similarity in twins' general cognitive ability and political interest also contributed to both their similarity in attained SES and in electoral PP.

The covariance between educational attainment and individual PP showed to be genetically confounded, with shared genetic factors explaining $\frac{1}{4}$ of the genetic variance in individual PP. Upon including general cognitive ability, political interest, and openness, a fraction of the formerly shared genetic variance remained (1%), with the largest proportion shared with the included individual characteristics (see Figure 2).

Finally, we found the covariance between educational attainment and collective PP to be genetically confounded (due to 6% of shared genetic variance). After including political interest, there was no uniquely shared covariance between educational attainment and collective PP (see Figure 2). Supplement G presents model (fit) statistics and comparisons of the multivariate analyses.

<Insert Figure 2 here.>

Discussion

Our findings come to add important new insights into the burgeoning literature on participatory inequalities. In contrast to long-established theoretical models, we did not find any quasi-causal associations between SES and emerging adults' political participation. While regression analyses yielded a significant link between SES and electoral PP, genetically informative analyses revealed confoundedness. The association between SES and electoral PP was confounded by shared environmental factors and the association of SES with individual and collective PP was confounded by genetic factors. The covariance between SES and emerging adults' PP mostly or fully overlapped with variance in political interest, general cognitive ability, and/or openness to experience, depending on the form of PP.

Electoral PP: Confounding due to Shared Environmental Factors

We found individual differences in electoral PP to be attributable to environmental factors shared between twins that also affect twin similarity in general cognitive ability, political interest, educational attainment, and household income. Although classic twin designs assume absence of genotype-environment interplay, different forms of genotype-environment correlation can show up as higher estimates of certain variance components. Passive genotype-

environment correlation can show up as a higher proportion of shared environmental effects. For example, twins' parents could affect their offspring's cognitive ability and political interest by buying certain newspapers or watching political talk shows, which could both lead to a higher likelihood of electoral PP and the attainment of a higher educational level. However, such behaviors would likely be associated with those parental individual characteristics that we considered in the regression analyses (e.g., their own general cognitive ability and political interest) and which we did not find to be significant. Still, this result could have been due to the stronger mediating effect of emerging adults' own individual characteristics. Alternatively, other shared environments, such as attributes of the childhood neighborhood, could also explain the finding (e.g., Jöst, 2023). In any case, in light of the importance of emerging adults' electoral PP, future research could strive to uncover these within-family factors.

Individual and Collective PP: Genetic Confounding

The link between educational attainment and individual and collective PP was attributable to shared genetic factors that were also shared by political interest and, in the case of individual PP, by general cognitive ability and openness. Among other things, genetic confounding may occur in the form of an *active genotype-environment correlation*. Young people may choose to pursue a higher educational level due to genetically influenced individual characteristics. Educational environments do not only provide a venue for (curricular) political discussions, but also the opportunity for exchanges with peers, potentially from diverse backgrounds. Given that young people in Germany today attain a higher school leaving qualification more often (i.e., A levels) and start studying compared to earlier generations, this may also override effects of social inequality to some extent. The finding could also reflect evocative genotype-environment correlation (see example in the introduction).

Unexplained Unique Environmental Effects

Neither differences in SES indicators nor in individual characteristics largely accounted for unique environmental variance in youth political participation. Peer influences may explain a part of the considerable unique environmental variance in youth PP (e.g., Quintelier, 2015a).

For example, interactions and discussions with friends or one's partner can stimulate political participation (Klofstad, 2010), more so than with family members.

Life events may also be profound for youth political participation. Following the political life-cycle theory, young people vote less than adults because they are preoccupied with “start-up” problems, leading them to be comparably less politically engaged (Smets, 2016). Hence, life changes may lead to differences in PP depending on “maturation” processes following normative life events. These may include moving and thus change of neighborhood or city. This presents another intriguing direction for future research endeavors.

Limitations

Our study has several limitations. We used a measure of political participation that was neither standardized nor encompassed additional relevant (online) forms of political participation. Given the very low resources required to engage in politics through digital means like social media (i.e., more modern forms of PP), and the increasing use of these tools for political expression, future studies and standardized surveys of the type used in this study should integrate these participatory forms. In addition, an overreporting of electoral PP may have biased our results (Dahlgaard et al., 2019).

Since the study is based on a representative sample that comprises a variety of measures on the socioeconomic background, we deem it unlikely that there is a sample- or measurement-specific error. In addition, for the considered variables, past studies showed the comparability of twin and singleton samples (Barnes & Boutwell, 2013; Christensen et al., 2006; Johnson et al., 2002). However, a twinship may increase socially active behavior (Pulkkinen et al., 2003) and unmeasured third variables may have suppressed the association in our cross-sectional data. Thus, future research should confirm our findings in a singleton sample, ideally with a longitudinal design. Moreover, future studies should test to what extent these findings are generalizable across different cultural contexts and other forms of political participation, particularly online and other modern forms of political participation. Differences between modern and traditional forms of political participation could also be distinctive for marginalized

groups, such as ethnic minority youth (e.g., Auxier, 2020) who can be overrepresented in lower socioeconomic groups (Gabrielli & Impicciatore, 2022; Heath & Brinbaum, 2014).

Conclusion

Using quasi-causal tests and incorporating a wide range of important individual characteristics, our analyses revealed the association between social inequality and youth political participation to be confounded. However, political participation is an exceedingly heterogeneous phenomenon (Theocharis & van Deth, 2018). Consequently, our findings need to be replicated in diverse social and cultural contexts and for different forms of political participation, especially more modern, digital forms of participation which are very popular amongst the younger generation which grew and socialized with them being in great variety and abundance.

Data Accessibility Statement

This study was not preregistered. TwinLife data and materials can be freely accessed (the former only for scientific purposes) via

https://search.gesis.org/research_data/ZA6701?doi=10.4232/1.13208. R scripts are available via https://osf.io/9w6kd/?view_only=41b55b62e4744759ad03b24c5ce7165f.

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Table 1*Demographic Statistics*

	<i>n</i>	Age			<i>n</i> monozygotic		<i>n</i> dizygotic	
		<i>M</i>	<i>SD</i>	Range	Total	Male	Total	Male
Twin pairs	983	23.05	0.82	21-25	524	213	458	198
Mothers	944	52.62	4.63	41-69				
Fathers	673	55.27	5.37	42-79				

Note. Dizygotic twin pairs were all same-sex.

Table 2*Measures of Personality Characteristics*

Construct	No. of Items	Measure (Reference)	McDonald's ω
General cognitive ability	56	Culture Fair Intelligence Test 20-R (Weiß, 2006)	.76-.82
Political interest	1	<i>Generally speaking, how interested are you in politics?</i>	
Self-efficacy beliefs	3	General Self-Efficacy Short Scale (Beierlein et al., 2013)	.72-.85
Interpersonal trust	3	Items from the German Socio-Economic Panel study (Richter et al., 2017)	.59-.66
Big Five personality traits	15	short Big-Five-Inventory (BFI-S; Schupp & Gerlitz, 2014)	openness: .60-.65 extraversion: .67-.81

Note. See Hahn et al. (2012) for details on the psychometric quality of the BFI-S.

Table 3*Results of the Regression Analyses*

Predictors (stand.)	SES only				SES + individual characteristics			
	Twin 1		Twin 2		Twin 1		Twin 2	
	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>
Electoral								
EA	2.16 [1.79, 2.62]	<.001	2.12 [1.76, 2.54]	<.001	1.31 [1.02, 1.69]	.037	1.44 [1.14, 1.82]	.002
Income (res.)	1.37 [1.05, 1.79]	.020	1.33 [1.02, 1.72]	.032	1.44 [1.06, 1.95]	.019	1.36 [1.02, 1.81]	.036
Occup. status (res.)	1.09 [0.89, 1.32]	.399	1.24 [1.03, 1.50]	.026	1.29 [0.90, 1.85]	.171	1.18 [0.86, 1.63]	.305
Working hours					0.82 [0.57, 1.19]	.291	1.02 [0.74, 1.40]	.921
PI					2.39 [1.87, 3.05]	<.001	2.22 [1.75, 2.81]	<.001
GCA					1.72 [1.34, 2.20]	<.001	1.70 [1.35, 2.15]	<.001
Individual								
EA	1.80 [1.54, 2.10]	<.001	1.75 [1.55, 1.98]	<.001	1.39 [1.14, 1.70]	<.001	1.20 [0.99, 1.45]	.062
Income (res.)	0.87 [0.73, 1.03]	.106	0.88 [0.74, 1.04]	.133	0.89 [0.74, 1.08]	.241	0.89 [0.73, 1.08]	.235
Occup. Status (res.)	0.94 [0.81, 1.08]	.347	1.02 [0.89, 1.17]	.724	1.05 [0.84, 1.32]	.658	1.22 [0.98, 1.51]	.077
Working hours					0.84 [0.66, 1.07]	.161	0.80 [0.63, 1.02]	.067
PI					1.84 [1.55, 2.17]	<.001	2.04 [1.72, 2.43]	<.001
GCA					1.23 [1.03, 1.46]	.023	1.29 [1.09, 1.54]	.004
Openness					1.33 [1.14, 1.55]	<.001	1.47 [1.25, 1.72]	<.001
Mother's PI					1.18 [1.01, 1.39]	.042	1.20 [1.02, 1.41]	.026
Collective								

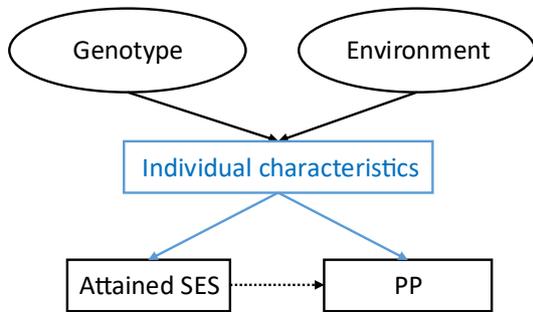
EA	1.51 [1.22, 1.88]	<.001	1.75 [1.40, 2.20]	<.001	1.12 [0.86, 1.46]	.398	1.18 [0.89, 1.58]	.255
Income (res.)	0.53 [0.39, 0.72]	<.001	0.77 [0.58, 1.02]	.073	0.60 [0.43, 0.83]	.002	0.77 [0.55, 1.07]	.117
Occup. Status (res.)	0.91 [0.75, 1.10]	.322	0.95 [0.78, 1.14]	.572	1.07 [0.80, 1.43]	.660	1.14 [0.85, 1.54]	.388
Working hours					0.77 [0.54, 1.08]	.132	0.80 [0.56, 1.15]	.231
PI					2.95 [2.34, 3.72]	<.001	3.40 [2.65, 4.36]	<.001
Interpersonal trust					1.21 [0.96, 1.52]	.100	1.38 [1.09, 1.76]	.009

Note. EA = educational attainment; occup. = occupational; PI = political interest; GCA = general cognitive ability; res. = residualized; stand. = standardized.

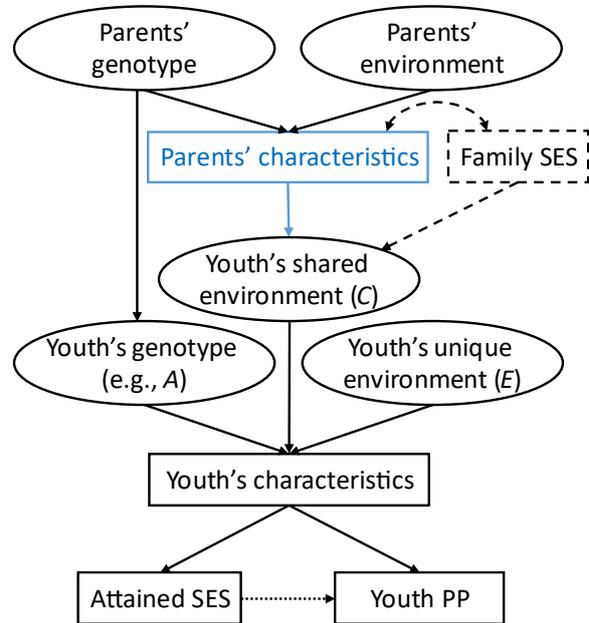
Figure 1

Schematic Depiction of Potential Confounding Pathways and Analyses

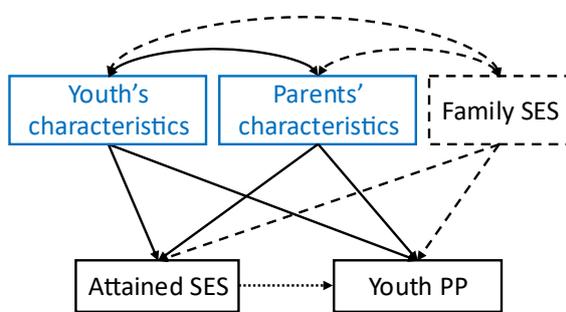
A. Confounding due to individual characteristics



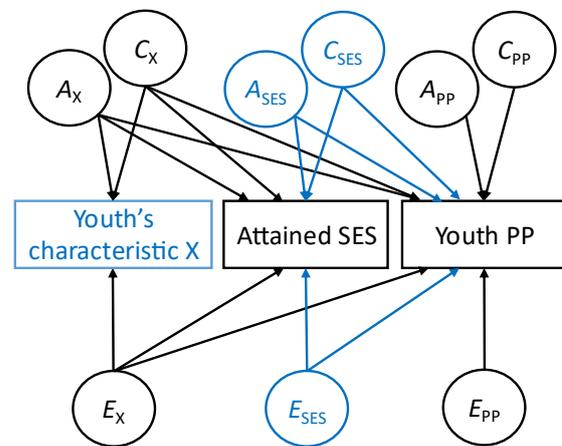
B. Genetic confounding due to passive genotype environment correlation



C. Phenotypically identifying confounding variables



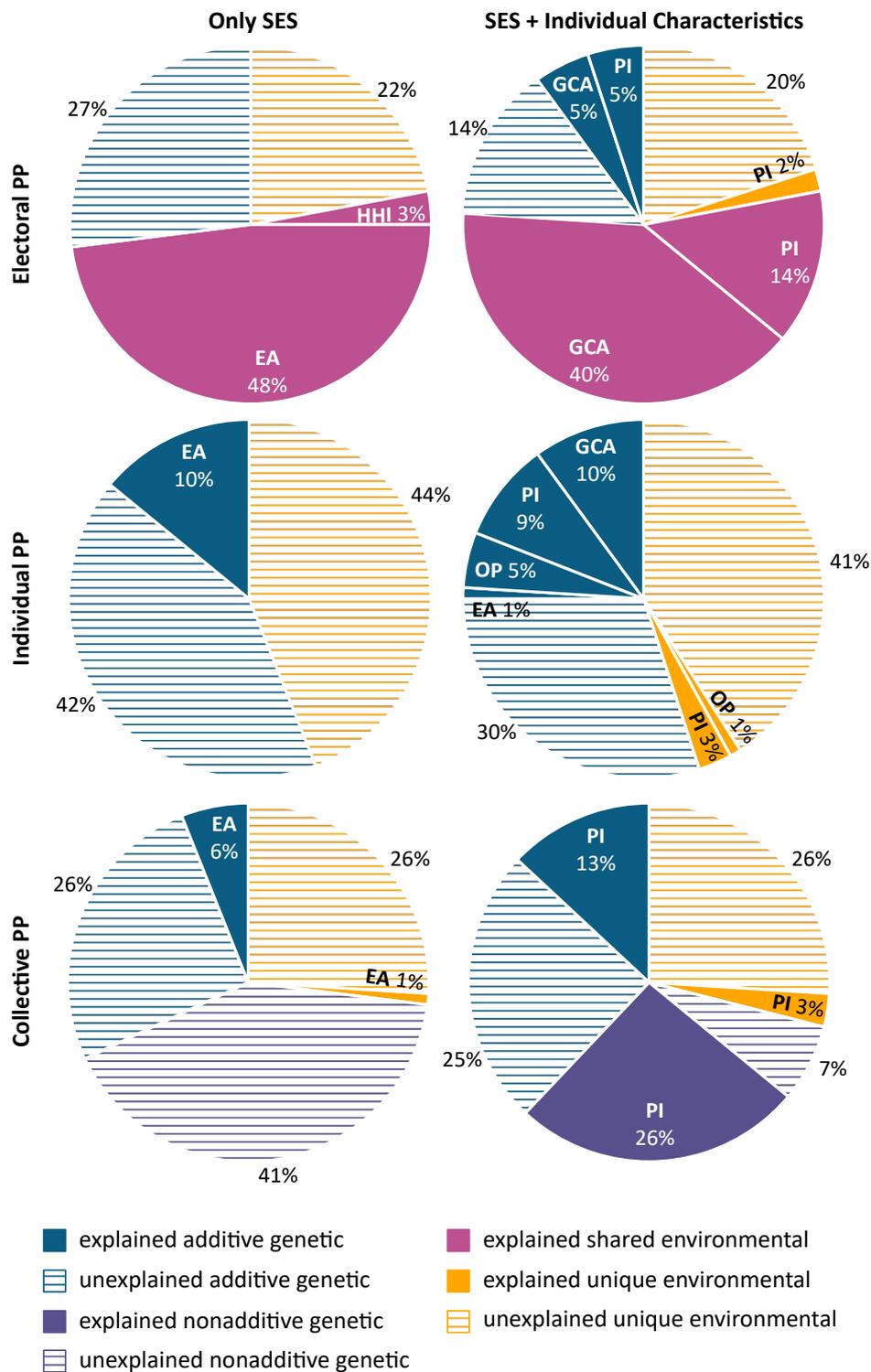
D. Identifying genetic and environmental pathways of confounding



Note. PP = political participation. See the main text for further description.

Figure 2

Results of the Genetically Informed Analyses



Note. PP = political participation; OP = openness to experience; PI = political interest; GCA = general cognitive ability.