Causality and confounding between Right Wing Authoritarianism, education, and Socio-Economic Status; a twin study

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Abstract

While it is well-established that education and Right Wing Authoritarianism (RWA) are quite strongly negatively correlated, it is still unclear why this is the case. There could be causal effects between these variables, in one or both directions, which can be either direct or mediated. And there could also be confounding third variables influencing their association. Using a sample of 320 monozygotic- and 312 dizygotic twin pairs, we were able to control for confounding influences from both genes and the family-environment, increasing our ability to infer causal effects. Furthermore, we investigate the roles of perceived Socio-Economic Status (SES) in both childhood and adulthood; SES in childhood could be a confound between education and RWA, and SES in adulthood could be a mediator. We explore these hypotheses with ACE- β models, which extend the logic of discordant twin designs into a structural equation framework. Our results are consistent with a causal effect of education to reduce RWA. SES in adulthood did not mediate this effect. We find that the negative correlation between RWA and education is further amplified by confounding influences, mostly from the family environment, which are partly associated with SES.

Introduction

Right Wing Authoritarianism (RWA) is a trait that is becoming increasingly relevant in light of recent developments in politics and culture. RWA is characterized by a willingness to defer to authorities, a desire that others should also be made to defer, and a preference for authorities that are well-established in the traditions and history of one's cultural group (Altemeyer, 1988). People with high RWA thus favor authoritarian enforcement of socially conservative morals and values.

A strong negative predictor of RWA is the amount of time spent in school and academia. The more years of education someone has completed, the less likely they are to hold authoritarian and socially conservative attitudes and views (e.g., Adorno, Frenkel-Brenswik, & Levinson., 1950/2019; Lipset, 1959; Stephens & Long, 1970; Pascarella & Terenzini, 2005). Support for this association is particularly strong in Western Europe and North America, but it has also been found in other cultures (see e.g. Weakliem, 2002). Substantial divergences between the most- and least educated have been found for attitudes on e.g. gender roles, convention, hierarchy, sexuality, and child rearing practices (e.g., Rowatt et al., 2009; Henningham, 1995), and regarding policy issues like reproductive rights, drug legalization, and same-sex marriage (Pew Research Center, 2016). Among college professors in the US, the ratio of self-identified liberal vs conservative on social issues is at around 8 to 1 or more across most fields of study (Rothman, Lichter, & Nevitte, 2005).

Many explanations have been proposed for why this negative association exists (see e.g. Stubager, 2008). Education could causally decrease RWA through various mechanisms (e.g. socialization or information acquisition); and low RWA could similarly cause you to get more education; and there can be confounds to the relationship, such as one's rearing environment or one's genes, which may affect both education and RWA. These categories of explanations are not mutually exclusive: correlations can have many causes at the same time.

In this study, we first investigate the extent to which the relationship between education and RWA is consistent with a causal interpretation. To do so, we use an adaptation of the discordant twin design into a structural equation framework, introduced by Kohler et al. (2011). As our sample consists of mono- and dizygotic twin-pairs, we are better able to make causal inferences than we would have been with standard correlational data. This is because monozygotic twins are completely matched on both genes and rearing environments, allowing us to control for confounds from these sources. Dizygotic twins are also matched on rearing environments, but only share on average 50% of segregating genes; by including dizygotic pairs in our sample we are then able to distinguish between genes and the shared environment as sources of confounding.

Furthermore, we explore whether perceived Socio-Economic Status (SES) constitutes a source of confounding and/or mediates the relationship between education and RWA. Lower childhood SES could be a confound associated with both decreased education and increased RWA in adulthood. And SES in adulthood could represent a mediator, such that higher education increase SES which then leads to decreased RWA.

Right Wing Authoritarianism and education

The Right-Wing Authoritarianism (RWA) scale was first developed by Altemeyer (1981) and is part of a family of similar scales all originating from Adorno's F-scale (1950). RWA is characterized by adherence to traditional moral authorities and -values (i.e. conservatism), combined with a preference that others should also be made to comply with these values (i.e. authoritarianism). RWA was initially split into three correlated sub-traits, which are: Authoritarian submission - submissiveness to established authorities; Authoritarian aggression - aggressiveness towards perceived deviants and outgroups; and Conventionalism - adherence to traditions and established

norms. Recent work has similarly differentiated the authoritarian aspects of the trait from conservatism and traditionalism (Duckitt & Bizumic, 2013).

For decades, RWA has been prominent in research on social- and political psychology. Attitudinal correlates of the scale have been investigated in a variety of populations and countries. For instance, RWA has been found to predict political affiliation, fundamentalist religiosity, aggression towards nonconformity and deviance, ethnocentrism, and generalized prejudice (e.g., Altemeyer, 1981, 1988; McFarland & Adelson, 1996; cf. also comprehensive reviews by Altemeyer, 1996, 1998; Duckitt & Sibley, 2009).

The negative relationship between education and authoritarian socially conservative attitudes was noted already in the initial presentation of the F-scale in 1950 (by Adorno et al.). Research on the connection was further fueled by the book *Political Man* (Lipset, 1959), with its chapter on “Working class authoritarianism”. Since then, a large amount of research has confirmed the connection for many different attitude variables in a wide range of populations (e.g., Stephens & Long, 1970; Weakliem, 2002; Pascarella & Terenzini, 2005). The description of the relationship has also been refined, for example by finding that certain types of education, such as vocational training, do not share the same relationship with conservatism as academic education (Zakrisson & Ekehammer, 1998).

The extant explanations on why education correlates negatively with authoritarian and socially conservative attitudes can broadly be grouped as either causal or non-causal.

Causal explanations for the negative association

We use the term “causal” here as per the framework by Rubin and colleagues (Rubin, 2001), building on earlier work by Neyman (Neyman, Dabrowska, & Speed, 1923/1990). In this framework, the causal effect of one unit of exposure to something is defined as the difference in scores on the outcome variable if the level of exposure differed by one unit. Thus, effects that work through one or several mediators are still classified as causal. As it is impossible to measure the same thing at the same time both with and without exposure to a causal variable, these kinds of causal effects can never be observed directly. But they can still be estimated, given the right kind of data.

In reviewing the literature, Stubager (2008) distinguishes between three categories of models for how education could causally affect RWA-type attitudes: psychodynamic-, cognitive-, and socialization models. In psychodynamic explanations, such as presented by Lipset (1969), the key mediating variable is the sense of security and mastery that can arise from education. Per such theories, education then reduces the need for stability from other sources, like traditional authorities and strict enforcement of norms. Sinn & Hayes (2018) similarly remark that social conservatism can have a stabilizing function. Adherence to- and enforcement of traditional moral rules can then be more attractive if one’s environment is in need of forces to stabilize it. In cognitive theories, the key mediating variables are instead knowledge and cognitive sophistication. Quoting from Clyde et al. (1978: 61), reduced conservatism then comes from “increased awareness of the varieties of human experience that legitimize wide variation in beliefs, values, and behavior”. Socialization models emphasize how people tend to internalize the values and beliefs of those they socialize with, and that students in universities will tend to socialize more with the kinds of people who study in universities, which are predominantly those who are low in conservatism.

Among the models above, both psychodynamic- and socialization models are consistent with the idea that the effect of education on RWA is mediated through SES: A sense of stability and mastery gained through education, as emphasized by psychodynamic models, could come about via an increase in actual and/or perceived SES. And so, too, could one’s degree of contact with the kinds of environments emphasized in socialization models.

Importantly, socialization models alone do not provide a complete account. For socialization to affect RWA, there needs to be some other explanation for why RWA *starts out* as low in higher

education environments; and/or some additional mechanism for why it becomes lower over time. For example, people with lower RWA might be more likely to enter higher education. This would then be an example of how causal effects can also go in the opposite direction, from having low RWA while young to increased education, through self-selection processes (Woessner & Kelly-Woessner, 2009).

Non-causal explanations for the negative association

There are also non-causal explanations of the relationship between education and RWA. There could be confounding factors associated with both increased education and lowered RWA, but which are not causally affected by neither RWA nor education. Such variables then amplify the negative correlation without mediating any causal effects.

In the present study, we investigate if the perceived SES of one's childhood environment could represent such a confound. Growing up in a high SES environment could affect both education and RWA, in opposite directions. An effect of childhood-SES to decrease RWA could work in similar ways to the models for the effects of education on RWA described above. As in psychodynamic models, growing up in environments that have high degrees of stability and order could reduce one's perception that authorities are needed to restrain behavior. High SES environments could also plausibly cultivate the kinds of beliefs and mental habits that lead to reduced RWA, as emphasized in cognitive explanations. And they could provide the kind of social environment whereby low-RWA type values are internalized through socialization with caregivers and peers.

High SES environments could also encourage education. For example, this could happen through pressure from norms and expectations, as those around you will tend to be highly educated. It could also work through cultivation of traits that lead to increased propensity to take higher education, such as intelligence (e.g., Strenze, 2007) and openness to experience (e.g., McCrae, 1996).

In this context, it is important to emphasize the difference between objective and perceived SES. Our measure of SES is the MacArthur scales of subjective social status (Adler & Stewart, 2007), which are pictures of ladders with ten steps, where higher steps indicate higher SES. It is thus a measure of how a person perceives their own SES, rather than an objective reading. Undoubtedly, however, perceived and actual SES are likely to be highly correlated. The distinction is still important, since there is work suggesting that how one perceives one's own SES can have effects on life outcomes above and beyond just objective measures of SES (Rivenbark et al., 2020).

Heritabilities of RWA and education

With the classical twin design, the variance of any metric that twins can differ on can be partitioned into three components: variance rooted in *genes* (fostering greater similarity between monozygotic than dizygotic twins); variance due to the *shared environment* (fostering similarities within both mono- and dizygotic twin pairs); and variance stemming from the *unique environment* of each person (making individuals within a twin pair less similar to one another).

In prior twin studies, both education (e.g. Heath et al., 1985) and social conservatism have been found to be substantially heritable (e.g. Eaves et al., 1999). And there is also recent work establishing the heritability of RWA in particular (e.g. Kandler, Bell, & Riemann, 2015; Ludeke, Johnson, & Bouchard, 2013).

Interestingly though, both of education and social conservatism have been found to have substantially more variance from the shared environment than what is typically found for most other traits. Polderman et al. (2015) meta-analyzed the heritability of human traits, and that heritabilities are typically in the range from ~.30 to ~.60, and that shared environmental variance is typically at ~.10 or lower for most traits. But in Heath et al. (1985), educational attainment has a shared environmental component above .30. And Eaves et al. (1999) similarly remark on how conservative vs liberal social attitudes have a markedly higher shared environmental component than other personality traits.

This then raises the possibility that these shared environmental variance components of education and social conservatism are overlapping. Truett et al. (1992) explored this question using multivariate Cholesky models, and found that both the genetic- and shared environmental components for education are partly overlapping with the corresponding components for social conservatism. This means that genetic/shared-environmental influences on education will tend to also influence socially conservative attitudes (in the opposite direction): the same genetic substrate and the same environmental factors influence both education and social conservatism.

However, it remains unknown whether this overlapping variance reflects the influence of other confounding variables (e.g. SES), or in fact expresses causal processes, such that education causes socially conservative attitudes (or vice versa).

The present research

Here, we investigate the nature of the well-established relationship between social conservatism and education. Specifically, we investigate the extents to which the negative correlation between education and RWA reflects causal processes and/or confounding. We also explore whether SES represents a mediator and/or a confound to the relationship between RWA and education. To do so, we construct a genetically informed mediation model, based on a formulation of the discordant twin design in a structural equation framework developed by Kohler et al. (2011). This design takes advantage of how twins are naturally matched on confounds in their genes and their shared environments, in order to control for these confounds in estimating effects. Any effects that remain when familial influences are taken into account are then more likely to reflect causal processes, as only confounds in the non-shared environment remain to be controlled for. Furthermore, we control for how perceived SES in childhood and adulthood can represent confounds or mediators to the relationship between education and RWA.

An important advantage of our approach over purely regression-based discordant twin designs is that we are able to distinguish between genetic- and shared environmental confounds. This is particularly relevant in this specific case, since our variables of interest have substantial variance from both genes and the shared environment, such that confounds could plausibly reside in both of these sources.

Materials and Methods

Participants

The twins in our sample were recruited from the Norwegian Twin Registry (NTR), which consists of several cohorts of twins. Our cohort, as registered by the NTR, consisted only of same-sex twins. A random sample from the cohort born between 1945 and -1960 were mailed a questionnaire, in 2016. From a response rate of 63%, we got 708 complete twin pairs responding, and 571 additional single responders. The mean age among responding twins was 63.19 (SD=4.52). For complete pairs with valid education- and RWA scores, our sample consisted of 124 male monozygotic twin pairs, 126 male dizygotic pairs, 206 female monozygotic pairs, and 186 female dizygotic pairs. This yielded a total of 642 twin pairs, or 1284 subjects. Zygosity was determined by a questionnaire shown to correctly classify >97% of twins (Magnus, Berg, & Nance, 1983).

Measures

Right Wing Authoritarianism (RWA)

Participants filled out the 15-item version of the Right-Wing Authoritarianism scale from Zakrisson (2005). Items are all statements that participants rate agreement with on 1-7 Likert scales from “Strongly Disagree” to “Strongly Agree”, such as “The ‘old-fashioned ways’ and ‘old-fashioned values’ still show the best way to live” and “Our country needs free thinkers, who will have the courage to stand up against traditional ways, even if this upsets many people” (reverse scored). RWA-scores are calculated as the average response across the items, with missing values imputed with the mean. Participants with missing responses to half or more of the items were excluded from further analyses.

Education

Educational level was measured by having participants indicate their highest completed level of education from the following alternatives: Elementary school; High School; Certificate of Apprenticeship; College/university less than 4 year; College/university more than 4 years; and Doctorate. As certificates of apprenticeship represent vocational training of the kind found not to predict decreased RWA (Zakrisson & Ekehammer, 1998), participants choosing this alternative were coded as having chosen high school. Then, responses were coded with a number from 1 to 5, with higher numbers for higher levels of education.

Perceived Socio-Economic Status in childhood and -adulthood

Perceived Socio-Economic Status was measured using the MacArthur scales of subjective social status (Adler & Stewart, 2007), which are pictures of ladders with ten steps each. Participants were told that the steps on top represented the people with most power and status, while the bottom steps were the opposite. And they were asked to place themselves on the ladders, as compared to the Norwegian population. There were two such ladders, one for the participants’ household in their childhood, and one for their current household.

Analyses

The classical twin design allows partitioning the variation of a trait into three components: A, C, and E. A is additive genetic influences, C is shared-environmental influences fostering similarities within twin pairs, and E is unique-environmental influences serving to make individuals within a twin pair less similar. Genetic effects are inferred when monozygotic (MZ) twins are more similar than dizygotic (DZ) twins; shared-environment effects are inferred when the correlation between DZ twins are more than half that of MZ twins. Unique-environment effects are inferred when MZ twins are less than perfectly correlated for a given trait, and this variance component thus also contains measurement error as well as the intrinsic molecular stochasticity in the process of building a phenotype from a genotype (Tikhodeyev & Shcherbakova, 2019). While these heuristics provide an instructive guide to the pattern of relative genetic and environmental effects, modern approaches typically involve multi-group structural equation modeling, which permit tests of parameter significance, as well as the estimation of parameters in multivariate models (Neale & Cardon, 2013). All models in the current study were fitted by full-information maximum likelihood using OpenMx (Boker et al., 2011). To control for any sex differences, sex was regressed out of the scores on all variables, and standardized residuals were used in subsequent twin analyses (cf. McGue & Bouchard, 1984).

Our analytic approach builds from ACE- β models, as introduced by Kohler et al. (2011). ACE- β models (Figure 1a) are reformulations of standard discordant twin analyses (see e.g. McGue et

al., 2010) into a structural equation framework. Discordant twin models take advantage of how twins are matched on rearing environments (regardless of zygosity) and genes (100% for MZ, 50% on average for DZ) in order to better infer causal effects. If differences on a variable *between twins in the same pair* predict within-pair differences on another variable, this is more strongly indicative of causal effects than what is typically achievable in non-experimental designs. When relationships between variables persist despite controlling for both genetics and rearing environments, the only remaining alternative to a causal interpretation (in one or both directions) is then that there are confounds in the unique environment.

ACE- β models reformulate this discordant twin logic into an SEM framework through simple alterations of standard Cholesky models. In a standard Cholesky, the A, C and E components of the first trait are allowed to also have paths onto the second trait. ACE- β models build from this by having an additional direct causal path from the first trait to the second. In order for ACE- β models to still be identifiable, the path from the E-component of the first trait onto the second trait is set to zero. In other words, it is assumed that unique environmental influences on the first trait do not also have effects on the second trait, except through the causal path. This formalizes the assumption of no E-confounding, which is required for making causal interpretations from discordant twin data.

Our initial model (Figure 1b) is a bivariate ACE- β model with education causally affecting RWA. The modeling framework forces one to choose a direction of causality, and we then chose education to be the causal variable. The main reason for this is that we only have access to *current* RWA scores, rather than RWA scores as they were >40 years ago, when our participants decided how much education to get. Current RWA cannot causally affect education, but education can have had causal effect culminating in the current RWA scores. (If the RWA scores in the past causally influenced decision on how much education to take, then RWA from the past can be conceptualized as a confound, affecting both education and current RWA.)

The logic for creating causal paths in ACE- β models can be expanded beyond the bivariate case. Building on from the initial model, we estimate a mediation model wherein the effect of education on RWA can be mediated by SES in adulthood, as described in figure 1c. Education can affect RWA directly, and also indirectly, mediated through its effect on adulthood-SES. The relationships between the variables can also be influenced by genetic- and/or shared environmental confounding, as represented by the paths from the A- and C- components of education onto adulthood-SES and RWA. Adulthood-SES theoretically cannot be a confounder between education and RWA, because it is causally and temporally downstream from education.

Our full model further builds from this mediation model, by allowing perceived SES in childhood to represent a potential confounder to all the causal paths in the previous model, including our main path of interest between education and RWA.

In summary, our full model (figure 1d) is a mediation model where the effect of education on RWA can be mediated through SES in adulthood, and where we estimate and control for confounding from both genetics and the shared environment. Furthermore we, investigate the extent to which confounding between these variables is captured by variance in childhood-SES.

Figure 1. Illustrations of models

Results

Descriptives

See table 1 for an overview of descriptive statistics. In our sample of 1284 individuals, 136 have elementary school as their highest completed level of education; 515 have high school; 401 have a degree from college or university of less than 4 years; 215 have a degree that lasted more than 4 years; and 17 have a PhD. 37.3% of the MZ pairs and 53.9% of DZ pairs were discordant on education level. The RWA scale had a Cronbach's α of .75. There was no significant gender difference in mean RWA-scores (men = 3.70, women = 3.73; $t(1282) = .72$, $p = .47$).

Table 1. Descriptives.

	MZ twins		DZ twins	
	Mean/%	SD/95% CI	Mean/%	SD/95% CI
<i>Demographics</i>				
Age	63.23	4.54	63.16	4.49
Female (%)	62.42		59.62	
<i>Education</i>				
Score	2.59	0.94	2.49	0.93
Within-pair difference	0.41	0.56	0.63	0.69
No difference (%)	62.5		47.1	
Twin correlation [95% CI]	.72	[.68, .76]	.50	[.44, .56]
<i>RWA</i>				
Score	3.70	0.83	3.73	0.82
Within-pair difference	0.54	0.46	0.64	0.55
No difference (%)	5.1		2.5	
Twin correlation [95% CI]	.65	[.60, .69]	.44	[.38, .50]
<i>C-SES</i>				
Score	5.60	1.59	5.64	1.67
Within-pair difference	1.08	0.99	1.22	1.01
No difference (%)	31.4		25.0	
Twin correlation [95% CI]	.58	[.52, .63]	.54	[.49, .59]
<i>A-SES</i>				
Score	7.14	1.33	7.07	1.36
Within-pair difference	1.04	1.03	1.29	1.21
No difference (%)	33.5		24.7	
Twin correlation [95% CI]	.34	[.27, .40]	.17	[.09, .24]

Notes. Within-pair difference is in absolute values.

Correlation between education and RWA

Education and RWA correlated at $-.48$ in our sample (95% CI $[-.53, -.43]$, $p < .001$). When exploring this relationship using regression models, we find that the effect of education appears to be quite linear.

Figure 2. Relationship between Education and RWA.

Notes. Means with 95% CIs around them. Dots are people, jittering is random. Shapes indicate densities: the wider the shape, the higher the density of people.

Biometric modeling

Univariate heritability analyses

Results from univariate heritability analyses for all four variables are in Table 2.

Table 2. Univariate heritabilities

Measure	A	C	E
Education	.45	.28	.27
RWA	.34	.28	.37
C-SES	.11	.49	.40
A-SES	.37	.00	.63

Notes. RWA is Right Wing Authoritarianism, C-SES is perceived SES in childhood, A-SES is perceived SES in adulthood. All values are significantly different from zero at $p < .01$, except the value that actually is zero (C for A-SES).

Both education and RWA have substantial variance components from the shared environment, almost equaling their genetic components. For perceived SES in childhood, the shared environmental component was at 48%, which aligns with how this variable measures an aspect of the shared environment. The remaining variance in this variable, which was 12% genetic and 41% unique environmental, we interpret as heritable response bias and measurement error, respectively. SES in adulthood had a larger genetic component than SES in childhood (at 37%) and, surprisingly, did not have any significant shared environmental variance at all in our sample.

ACE- β modeling

As a preliminary step in our analytic approach, we constructed a bivariate ACE- β model with only education and RWA (Figure 1b). Here, we found a significantly negative causal path from

education onto RWA, and we also found significant shared environmental confounding. Genetic confounding between the two variables was not significant.

In the second model, where we investigated if this causal path was mediated through SES-A, we found that this was not the case. As one would expect, education did indeed causally affect SES-A, but there was no significant path from SES-A onto RWA. (See the online supplement for more details on the first and second model, as well as univariate heritability analyses for all four variables.)

Parameter estimates for the full model (shown in Figure 1d) are shown in Table 2. Our main parameter of interest, the direct causal path from education to RWA, was significantly negative in our model. Additionally, there was significant shared environmental confounding. Education had a significant C-component, which loaded negatively on RWA. And the C-component of SES-C had a positive loading on Education and a negative loading on RWA, further contributing to the negative correlation between these two variables.

Figure 4 details how our results suggest that the covariance between education and RWA is to be explained. 23% of the covariance is from the causal path from education onto RWA. The remaining covariance is largely explained by how the A and C components of education (after C-SES is accounted for) have negative paths onto RWA. Only 7% of the covariance is due to confounding family environmental influences from childhood-SES.

Education had a significant causal path onto SES-A, but there was no mediation effect of SES-A between education and RWA, as the path from SES-A to RWA was not significant.

67% of the variance in RWA was unaccounted for by the other variables in the model. All of the A, C, and E components unique to RWA were significant, with the largest reduction as compared to the univariate analyses of RWA was for the C-component (meaning that the C-component in the univariate analysis largely overlapped with the C-components of education and childhood-SES).

Table 2. Parameter estimates in the full model.

Parameter	Estimate	Parameter	Estimate	Parameter	Estimate
<i>C-SES</i>		<i>C-SES -> Edu</i>		<i>Edu -> A-SES</i>	
a ₁₁	√.12*	a ₂₁	-√.02	a ₃₂	√.12*
c ₁₁	√.48*	c ₂₁	√.12*	c ₃₂	-√.02
e ₁₁	√.41*	p ₂₁	.00	p ₃₂	.08
<i>Edu</i>		<i>C-SES -> A-SES</i>		<i>Edu -> RWA</i>	
a ₂₂	√.41*	a ₃₁	√.02	a ₄₂	-√.05*
c ₂₂	√.18*	c ₃₁	-√.05	c ₄₂	-√.13*
e ₂₂	√.27*	p ₃₁	.39*	p ₄₂	-.14*
<i>A-SES</i>		<i>C-SES -> RWA</i>		<i>A-SES -> RWA</i>	
a ₃₃	√.12*	a ₄₁	-√.00	a ₄₃	-√.03
c ₃₃	√.00	c ₄₁	-√.04*	c ₄₃	√.00
e ₃₃	√.58*	p ₄₁	.05	p ₄₃	.05
<i>RWA</i>					
a ₄₄	√.24*				
c ₄₄	√.06*				
e ₄₄	√.37*				

Notes. Heritability parameters are represented as squareroots of their squared values to better represent their contributions to phenotypic variance. “a”, “c”, and “e” are genetic-, shared-environmental-, and unique-environmental parameters, respectively. “p”-parameters are causal paths. Subscripts denote the destination and origin of paths, with 1 = Childhood-SES; 2 = Education; 3 = Adulthood-SES; 4 = RWA. *p ≤ .05.

Figure 3. Full model

Notes. For clarity, only statistically significant paths are included. Solid paths are positive, dashed paths are negative.

Figure 4. Proportions of the covariance between education and RWA explained by different sources

Notes. Edu is education and C-SES is childhood-SES. The full column, representing the entire covariance between education and RWA, is divided into pieces representing the impact of the various contributors to this covariance in our full model. A- and C-confounding with education only represents the confounding that is independent of childhood-SES. The remaining sources of covariance in our model are all combined in “Other”, including the mediated path from education to RWA that goes via SES in adulthood. This Other-component is practically invisible in the figure, as it explains less than 1% of the covariance between education and RWA.

Discussion

Our findings in this exploration of the relationship between level of education and Right Wing Authoritarianism (RWA), are consistent with the following six claims: (1) Both education and RWA are influenced by the rearing environment, in addition to genes; (2) Education and RWA are substantially negatively correlated; (3) There is a causal effect of education to decrease RWA; (4) This effect does not appear to be mediated by Socio-Economic Status in adulthood; (5) There are confounding influences in both genes and the shared environment which further strengthen the negative correlation between education and RWA; and (6) A small proportion of the shared environmental confounds are related to SES in childhood.

Heritabilities

Consistent with prior research (e.g. Heath et al., 1985; Eaves et al., 2009; Truett et al., 1992), we find that both education and RWA have substantial variance components from the shared environment, at .28 for both variables. For SES in childhood, the shared environmental component was at .49, which aligns with how this variable measures an aspect of the shared environment. The remaining variance in this variable - 11% genetic and 40% unique environmental - we interpret to represent heritable and environmental influences on how SES is perceived, and also measurement error. Surprisingly, SES in adulthood did not have any significant shared environmental variance. This suggests that the rearing environment had little impact on adulthood-SES in our sample (though it is also possible that non-additive genetic effects can mask shared environmental influences from our analyses, see e.g. Chen et al., 2015). Education, RWA and adulthood-SES all had substantial genetic variance components, at around .40, which aligns well with the typical level of heritability found for most psychological and social traits (Polderman et al., 2015).

Relationship between Education and RWA

Phenotypically, education and RWA had a substantial negative correlation in our sample, at $r = -.48$. In analyzing this relationship using a genetically informative sample, our results are consistent with a causal effect of education to reduce RWA, explaining 29% of this correlation. This causal effect appears to not be mediated by SES in adulthood. The remaining 71% of the covariance is due to the influence of confounders, both in genes (25%) and in the rearing environment (46%). The confounding from the rearing environment partly overlapped with variance in perceived childhood SES, explaining 15 out of the total 46% of covariance from the rearing environment.

In total, education and SES in childhood and adulthood explained a total 33% of the observed variance in RWA in our sample, meaning that 67% of variance in RWA remain unexplained (though measurement error is likely to represent a part of this).

Causal effects

Out of the six causal paths in our full model, only two were statistically significant: Our main path of interest, from education onto RWA, and the path from perceived childhood SES onto perceived adulthood SES. We discuss these paths in turn.

Causal effect of education on RWA

The causal effect of education on RWA appears not to be mediated by the effect of education on adulthood SES. This goes against the idea that the effect of education to reduce social conservatism comes from providing an increased sense of security, to the extent that this comes about via an increase in SES.

Our modeling approach required us to specify the direction of causality between education and RWA. We here chose to model an effect of education on RWA, rather than the other way around, since we only have access to participants' *current* RWA scores, not the ones they had when they got their education. If RWA causally effects education, this would be an effect of RWA as it was when our participants were younger. This RWA in the past can then rather be seen as a confounding variable, potentially influencing both education and current RWA. Importantly though, we do not mean to imply that participants' RWA did not also causally influence their level of education: we cannot rule out this possibility based on our findings, and we see it as completely plausible.

The causal effect of education on RWA in our model persisted despite allowing for confounding and mediation through SES. An important caveat here is that causal effects are estimated with an assumption that there is no unique environmental confounding. To the extent that this assumption is broken, our estimates of causal effects will be exaggerated. Unique environmental confounding can occur through unique experiences that affect RWA and education in opposite directions, as well as through unique environmental influences on confounding traits.

Estimates of causal effects are also affected by random measurement error. But as opposed to unique environmental confounding, measurement error *attenuates* estimates of causal effects. Errors in the measurement of either education or RWA contribute unique environmental variance that is not shared with the other trait, and this then reduces estimates.

Causal effect of childhood-SES on adulthood-SES

Even though it is not the main focus of this investigation, the other significant causal path in our model, from childhood SES onto adulthood SES, has some subtleties that are worth discussing. Our measures of SES, the MacArthur ladders (Adler & Stewart, 2007), only measure how our participants perceive their own SES. The causal arrow could then represent a causal effect of how one's childhood is remembered on current SES and/or how current SES is perceived. Or, as with education and RWA, we cannot fully rule out the opposite casual direction, such that current living conditions (or perceptions thereof) color one's perceptions of the past.

The most plausible interpretation of the effect, however, might be that one's childhood SES simply carries over into adulthood to some extent: Starting out further down the ladder makes it harder to climb all the way up, and vice versa. And while we only have measures of perceived SES, these undoubtedly correlate quite strongly with a person's objective, true SES. However, variance in *true* childhood SES is purely shared environmental, by definition. One's genes or unique experiences cannot make it so that someone has higher SES than their dizygotic twin when they are both growing up in the same house. So if there is indeed such an effect of childhood SES being carried over into adulthood, this would only be represented by an overlap in shared environmental variance between the two measures. We do see such overlap, but we also see overlap in unique environmental variance, meaning that a model with a substantial causal path achieves better fit to the data. While unique environmental influences *can* influence how SES in both childhood and adulthood are perceived, it should also be mentioned that the two measures were right next to each other in the survey. The first response might then have served as an anchor for the second response, so that we get correlated measurement errors, which implies overlap in unique environmental variance.

Confounding

The remaining covariance between education and RWA which is not explained by causal effects, can, by method of elimination, be interpreted as due to confounding variables. We find such confounding influences from both genetic and shared-environmental sources. Genetic confounding between education and SES can include e.g. genetic influences on personality or cognitive ability. For example, openness to experience in the Big Five personality inventory correlates positively with

education (e.g., McCrae, 1996) and negatively with RWA-type attitudes (Brandt, Chambers, & Crawford, 2015). Our analyses suggest that a large part of the confounding influences are rooted in the shared environment. Plausible shared environmental confounders include parental influences, but also other aspects of the social environment, such as the general level of education of one's peers.

The roles of Socio-Economic Status

Our analysis estimated the extent to which confounding between education and RWA was captured by SES in childhood. We found that 15% of the total covariance between education and RWA was explained by variance in childhood-SES. This then suggests that environments where others are highly educated work to both increase education and reduce RWA, to some extent. An environment with high education would also tend to be one with high SES. But the variance in parenting and social environments that explains the covariance between education and RWA appears to be mostly independent of SES. We also did not find any role for SES in adulthood in mediating the causal effect of education on RWA. The hypothesis that education affects RWA through its effects on SES was then contradicted.

Limitations and future directions

An important limitation of our study is that our sample consists solely of people who are between 60- and 65 years old. Norms and parental practices might have been different in the 1970s, in ways that influence our findings, and so we advise caution in generalizing our results to other age groups. And the nature of educational institutions, both socially and academically might very well have been different then as well, in ways that are relevant to our results. Similarly, generalizability of our results is also limited in terms of culture and ethnicity, since our sample is almost exclusively ethnically and culturally Norwegian.

Future studies could look at the roles of variables such as IQ and religiosity in this context, and they could see if the causal effect of education on RWA, as well as their shared genetic and environmental relationships with childhood SES still hold across other age and ethnic groups.

Conclusion

By using an adaptation of the discordant twin design in a structural equation framework, we find partial support to prior theory on how education can causally impact authoritarian social conservatism. Our results are consistent with a negative causal effect of education to reduce Right Wing Authoritarianism (RWA). This effect was not mediated by the effect of education on SES in adulthood, and we thus contradict prior theory to suggest this. The causal effect of education only explained 29% of the total covariance between education and RWA, however. In analyzing the confounding influences that then explain the remaining covariance between the two variables, we find that there appears to be substantial confounding both from genes and from the rearing environment. These environmental confounds were largely, but not fully, independent from childhood-SES.

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