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# The Genetic Basis of Political Sophistication

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Political sophistication is a concept that encompasses political reasoning, the coherence of people's issue attitudes, and their knowledge of political processes. To what extent is political sophistication affected by genes and environments? Do these distinct but related measures of sophistication share a common genetic structure? We analyze survey data collected from participants in the Minnesota Twin Registry to estimate influences of genes and environments on variables used to measure political sophistication. Additive genetic factors explain 48–76% of the variation in educational attainment, political interest, and political knowledge, while dominance genetics influence 28% of the variance of ideological consistency. Multivariate analyses show that, although these measures share common genetic and unique environmental factors to a modest extent, much of the variance is explained by specific genetic and unique environmental factors. Ideological consistency appears to be mostly distinct from the other measures, as it is strongly accounted for by unique environmental influences.

■ **Keywords:** politics, education, interest, knowledge, ideology, twins, behavior genetics

Political scientists have long been interested in the political sophistication of voters (Campbell, Converse, Miller, & Stokes, 1960). Individuals who possess it are able to make sense of politics in terms of an overarching ideology that maps onto the discourse among political elites, while individuals who do not possess it rely on blunter heuristics such as partisan and group-based identities or the performance of the economy to guide their political attitudes (Lavine & Gschwend, 2007). In this view, political sophisticates approximate an ideal of democratic citizenship, reasoning about politics using abstract principles.

Political science research anticipates political sophistication is a function of three factors: means, motive, and opportunity (Luskin, 1990). Politics is complex. There are a multiplicity of issues, actors, and institutions that bear on policy debates. People must possess the cognitive ability to cut through the complexity of issues and rhetoric to understand which policy proposals align with their underlying predispositions (Goren, 2004). Predispositions reflect deeply held worldviews that inform people's preferences about appropriateness of action (Graham, Haidt & Nosek, 2009; Jost, Converse, Miller, & Stokes, 2003). Yet the ability to develop an organized and coherent set of political attitudes is of little use if individuals do not have the opportunity to pay close attention to politics, or the motivation to do so.

Political sophistication has been measured using various indicators: educational attainment, expressed interest in following politics, knowledge of basic political facts, and the degree to which attitudes on various political issues are consistent with the liberal–conservative ideological continuum as constructed by elite discourse (Weisberg & Nawara, 2010). Although each of these measures captures a particular facet of political sophistication, they appear to arise from distinct and overlapping sources. Educational attainment arguably measures cognitive ability, but it does not cleanly capture motivation or opportunity (see Highton, 2009). Many educated individuals voraciously consume political information, while others either have little interest or time to do so. Interest in politics reflects a motivation to keep up with political events and debates, but

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does not necessarily coincide with the opportunity or ability to do so. Likewise, knowledge of political terms and actors is likely driven by an interest in politics that motivates individuals to consume political information, but is conditional on the opportunity to do so and ability to assimilate the information received (Zaller, 1990; 1992). The possession of coherent political attitudes is likely driven by the cognitive ability to 'put what goes with what' (Converse, 1964, p. 212), conditional on one's awareness of politics and cognitive ability.

Regardless of the empirical measure of political sophistication, political scientists have tended to assume that individuals become politically sophisticated as a function of environmental influences — family influence in particular (Luskin, 1990). The prevailing notion is that politically sophisticated parents teach their children to be engaged, interested, and sophisticated citizens themselves. This purely environmental model of political sophistication is contrary to the extant evidence flowing from behavior genetics research. Compelling evidence demonstrates that cognitive ability (Bouchard & McGue, 2003; Wright et al., 2001), educational attainment (Heath et al., 1985), and the motivation to engage in politics are all partially heritable (Fowler, Baker & Dawes, 2008). These factors form the foundation of political sophistication.

Modern societies possess many diversions, making it easy to avoid paying much attention to political news and events. If the desire to consume political information is innate to some extent, then genetic variation should account for some of the variation in individuals' interest in politics. Cognitive ability and educational attainment fill in the other aspects of political sophistication by providing politically interested individuals with the tools to retain factual information about politics and develop belief systems that reflect political discourse. Because political interest, knowledge, and ideological consistency flow from heritable dispositions, we expect these phenotypes to exhibit heritability as well. Moreover, if it is the case that these indicators are related but distinct aspects of political sophistication, we should find evidence that these phenotypes are explained in part by a common set of genes and in part by unique genes.

## Methods

### Participants

We used data from U.S. adult twin pairs born between 1947 and 1956 who participate in the Minnesota Twin Registry (Lykken, Bouchard, McGue, & Tellegen, 1990). Twin registry participants were recruited for a survey of social and political attitudes, conducted between July 13 and October 30, 2009. Details of the sampling and survey procedures are described elsewhere in this special issue (Hatemi, in press). No twins of unlike sex were included in this study. The sample analyzed here includes 213 monozygotic (MZ) female, 143 MZ male, 154 dizygotic (DZ) female, and 86 DZ male twin pairs, and 157 single twins whose cotwin did not participate in the survey. These are included in the Maximum Likelihood analysis for their contribution to the estimation of means and variances.

### Measures

***Education.*** Self-reported educational attainment was measured using a single item with six response categories: *no high school diploma*, *completed high school*, *training after high school*, *some college* (including a two-year degree), *four-year college degree*, or *graduate training after college*. We recoded this variable between 1 and 5, with higher numbers indicating more formal education. Given the small number of respondents with no high school diploma, we recoded these respondents into a category representing the lowest level of education.

***Interest in Politics.*** Respondents were asked their level of interest in politics and public affairs and allowed to choose among the following categories: *very interested*, *somewhat interested*, *not too interested*, or *not at all interested*. The variable is coded between 1 and 4, with higher numbers indicating greater interest.

***Political Knowledge.*** The questionnaire contained a five-item battery of political knowledge: Respondents were asked five questions about political processes and U.S. institutions, including who is responsible for deciding if a law is constitutional (U.S. Supreme Court), who nominates judges to federal courts (President), which major political party is more conservative at the national level (Republicans), the required majority for the U.S. Congress to override a presidential veto (two-thirds majority), and the main duty of the U.S. Congress (to write laws). We summed correct responses to these questions. Again, given the relatively small number of respondents who answered no questions correctly, we combined the two lowest categories.

***Ideological Constraint.*** Participants' ideological consistency, or constraint, was assessed using several survey items concerning political issues, including public prayer, socialism, immigration policy, the death penalty, abortion access, the war in Iraq, social welfare programs, gun control, military spending, pollution, the appropriate size of government, tax policy, stem cell research, and the use of torture. Respondents were asked to indicate agreement or disagreement with each of these policies, as well as uncertainty. Those who *agreed* or *disagreed* were asked to indicate whether their opinion was held *very strongly*, *strongly*, or *not strongly*. We recovered a 7-point scale coded with conservative positions indicated by higher numbers. We used the standard deviation of these issue scales (Barton & Parsons, 1977) as a measure



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of ideological constraint and recoded it between 1 and 5, with higher numbers indicating greater ideological consistency. This continuous variable was partitioned at the 20th, 40th, 60th, and 80th percentiles. This allowed us to estimate ordinal multivariate models. This measure of ideological consistency is not correlated with either issue-based political ideology ($r$ = .03, $p$ =.25) or self-reported ideology ($r$ = .02, $p$ =.56). It essentially measures how consistently a liberal is a liberal or a conservative is conservative. People who indicate constraint on this measure have been shown to reason about politics more rigorously than people who exhibit a lack of constraint. For example, ideologically constrained individuals are less likely to assume that a preferred candidate shares their issue attitudes (i.e., projection), but rather assess a candidate on the basis of the candidate's issue positions (Wycoff, 1980).

***Univariate Analyses.*** Structural equation modeling informed by the classical twin design was used to decompose variation in each of these phenotypic traits into an additive genetic component (A), a common environmental component (C) or a nonadditive genetic component (D), and a unique environmental component (E). With only MZ and DZ twins reared together, we are only able to estimate either ACE or ADE models for each phenotype. While the identification of significant nonadditive genetic components is uncommon in political behavior genetics (, Medland, Morley, Heath, & Martin, 2007), we consider them given the pattern of MZ and DZ correlations we observe for one of the traits. In the ACE models, the covariance of nonidentical twins was specified as .5A + C, where MZ twins are perfectly correlated for A and C. In the ADE models, the covariance of nonidentical twins was specified as .5A + .25D. Models were fit using OpenMx (Boker et al., 2011) statistical software implemented in the *R* statistical computing environment.

***Multivariate Analyses.*** We tested three multivariate models: a four-item Cholesky decomposition, independent, and common pathway specifications (Neale & Cardon, 1992). Each of these models anticipates different ways genes and environments influence relationships among the four variables. The Cholesky decomposition is the most general approach to modeling the variance–covariance structure and tests no specific hypotheses about these relationships. Instead, it models all possible paths of genetic and environmental influence. It assumes an ordering in which genes that influence the first specified variable also influence the second specified variable; an additional set of genes may influence the second variable only (Loehlin, 1996). In each of the models, we assume an ordering: educational attainment precedes interest in politics, which precedes political knowledge, and, finally, political sophistication.

The independent pathway model hypothesizes that common genetic and environmental influences partially explain the covariance of the four sophistication measures, along with specific genetic and environmental influences. The common pathway model assumes that genes and the environment affect a common latent variable, which in turn affects the covariance between these measures of political sophistication. As a result, the contribution of the shared genetic and environmental influences is similar for each combination of variables. The OpenMx software was used to estimate these models.

**TABLE 1**

Summary Statistics and Phenotype Correlations Among Indicators of Political Sophistication

| | Minnesota Twin Study | | 2008 ANES | |
|---|---|---|---|---|
| | Mean | Standard deviation [skewness, kurtosis] | Mean | Standard deviation [skewness, kurtosis] |
| Summary Statistics | | | | |
| Education | 3.00 | 1.34 [0.003, 1.84] | 2.28 | 1.43 [0.67, 1.98] |
| Political interest | 3.08 | 0.71 [–0.46, 3.11] | 3.30 | 0.87 [–1.06, 3.21] |
| Political knowledge | 3.59 | 1.42 [–0.62, 2.03] | NA | NA |
| Ideological constraint | 2.99 | 1.41 [0.01, 1.71] | 2.83 | 1.41 [0.21, 1.79] |
| Correlations | Education | Political interest | Political knowledge | |
| Minnesota Twin Study | | | | |
| Political interest | .22* | | | |
| Political knowledge | .45* | .25* | | |
| Ideological constraint | .18* | .02 [p = 0.41] | .19* | |
| 2008 ANES | | | | |
| Political interest | .23 | | NA | |
| Ideological constraint | .11* | .05 [p = .07] | NA | |

Note: 2008 ANES = the 2008 American National Election Study; the 2008 ANES did not have a comparable measure of political knowledge.
* p < .001.



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**TABLE 2**

Mean Scores for Indicators of Political Sophistication and Twin Correlations

| | MZ twins | | DZ twins | | Polychoric correlation ($\rho_{T1,T2}$) (SE) | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | MZ | DZ |
| Education | 3.01 | 1.34 | 2.98 | 1.33 | .77 (.03)* | .38 (.06)* |
| Political interest | 3.09 | 0.72 | 3.07 | 0.69 | .49 (.06)* | .23 (.08)† |
| Political knowledge | 3.55 | 1.52 | 3.52 | 1.53 | .62 (.04)* | .35 (.07)* |
| Ideological constraint | 3.03 | 1.41 | 2.95 | 1.41 | .29 (.06)* | .05 (.07)** |

Note: SD = standard deviation; MZ = monozygotic; DZ = dizygotic. A skewness-kurtosis test rejects the assumption of normality for each of these variables; consequently, we report polychoric correlations.
† $p < .01$; * $p < .001$; ** $p = 0.478$.

## Results

### Preliminary Analyses

Table 1 reports the phenotypic correlations among education, political interest, political knowledge, and ideological constraint, as well as summary statistics for both the Minnesota Twin Study and the 2008 American National Election Study (ANES), which is a nationally representative survey (For description of the data and a comparison of these traits to the national representative ANES for the same year, see Smith, et al. 2012). The measures from the ANES are roughly comparable to the measures in the Minnesota Study. Education was coded using the same five-point scale, and political interest was coded using the same four-point scale. The ANES did not include as many items for the constraint measure, however, because it only included comparable opinion items on the Iraq war, military spending, taxes, and torture. The standard deviation of the summary score for these items was taken, and respondents were placed on a five-point scale using quintiles as the cut points, as with the constraint measure for the Minnesota Study. Unfortunately, the 2008 ANES did not include a comparable measure of political knowledge. Respondents in the Minnesota Twin Study are more educated, on average, than the respondents in the nationally representative sample, but are similar with respect to political interest and ideological constraint. Also, as Table 1b shows, the correlations among these variables are quite similar for both the Minnesota Twin Study and the ANES.

**TABLE 3**

Standardized Variance Components [95% Confidence Interval] for Sophistication Measures

| | $a^2$ | $c^2$ | $d^2$ | $e^2$ | –2LL | AIC | *p*-value (comparison) |
|---|---|---|---|---|---|---|---|
| Education | | | | | | | |
| ACE | .73 [.48, .80] | .03 [.00, .26] | – | .24 [.19, .30] | 3,468.66 | 1,152.66 | |
| AE | .76 [.70, .80] | – | – | .24 [.20, .30] | 3,468.71 | 1,150.71 | .83 (ACE) |
| CE | – | .62 [.56, .68] | – | .38 [.32, .44] | 3,508.88 | 1,190.88 | .00 (ACE) |
| E | – | – | – | 1.0 [1.0, 1.0] | 3,728.54 | 1,408.54 | .00 (ACE) |
| Interest | | | | | | | |
| ACE | 40 [.05, .57] | .07 [.00, .38] | – | .52 [.04, .63] | 2,396.79 | 58.79 | |
| AE | .48 [.38, .57] | – | – | .52 [.43, .62] | 2,396.97 | 56.97 | .67 (ACE) |
| CE | – | .40 [.32, .49] | – | .60 [.51, .68] | 2,401.90 | 61.90 | .02 (ACE) |
| E | – | – | – | 1.0 [1.0, 1.0] | 2,469.98 | 127.98 | .00 (ACE) |
| Knowledge | | | | | | | |
| ACE | .58 [.28, .70] | .05 [.00, .31] | | .37 [.30, .46] | 3,388.59 | 1,056.59 | |
| AE | .63 [.55, .70] | – | – | .37 [.30, .45] | 3,388.71 | 1,054.71 | .73 (ACE) |
| CE | – | .51 [.44, .58] | – | .49 [.42, .56] | 3,403.99 | 1,069.99 | .00 (ACE) |
| E | – | – | – | 1.0 [1.0, 1.0] | 3,529.79 | 1,193.79 | .00 (ACE) |
| Constraint | | | | | | | |
| ACE | .26 [.06, .36] | – | .00 [.00, .16] | .74 [.64, .85] | 3,797.00 | 1,435.00 | |
| ADE | .00 [.00, .34] | – | .28 [.00, .38] | .72 [.62, .83] | 3,795.45 | 1,433.45 | |
| AE | .26 [.15, .36] | – | – | .74 [.64, .85] | 3,797.00 | 1,433.00 | 1.00 (ACE)<br>.21 (ADE) |
| E | – | – | – | 1.0 [1.0, 1.0] | 3,819.73 | 1,453.73 | .00 (ACE, ADE) |

Note: -2LL=-2xLog Likelihood; AIC=Akaike Information Criterion; A=Additive genetics; C = Common environment; E = Unique environment



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Table 2 reports the mean scores and standard deviations for each of these among monzygotic and dizygotic twins in the sample, as well as the polychoric correlation between each twin's phenotype scores for the groups of twins. Note that there are no significant differences in means between MZ and DZ twins, which lends support to the equal environment assumption (EEA); see Hibbing and Smith (2011) for a more thorough consideration of the appropriateness of the EEA in this data. The larger correlations among monozygotic twins compared to dizygotic twins suggest potential genetic effects. However, the substantially larger correlation for monozygotic twins for ideological constraint, nearly six times the size of the dizygotic twin correlation, is consistent with a nonadditive genetic component at work, and suggests the inclusion of genetic dominance instead of the common environment in a univariate model.

### Univariate Results

Univariate models containing additive genetic, common environmental or dominance genetic, and unique environmental variance components were fitted to each indicator to determine which model best explains facets of political sophistication. These are presented in Table 3. For education, interest, and knowledge, only the AE model was not significantly worse fitting than the ACE model and provided a more parsimonious fit to data for each indicator. Each of these AE models indicated a substantial heritability for political sophistication: education ($a^2$ = .76), political interest ($a^2$ = .48), and political knowledge ($a^2$ = .63).

Given the correlations for MZ and DZ twins ($r_{DZ} < .5r_{MZ}$), with the MZ correlation approximately six times the DZ correlation, we anticipated that a model for ideological constraint with dominance genetic effects would be superior to those with common environmental effects. The ADE (AIC = 1,433.45) model fitted the data slightly better than an ACE model (AIC = 1,435), but not reliably so ($p$ = 1.0). The differences between both the ACE and ADE models and the AE model were not statistically significant, and the AE model offered a more parsimonious specification ($a^2$ = .26). Although the ADE model suggested that most of the variance was accounted for by genetic dominance ($d^2$ = .28) rather than by additive genetic factors, it is not biologically plausible for a model with dominance to lack genetic additivity. Nonetheless, both models indicated a substantial genetic influence on ideological constraint.

### Multivariate Results

We compared the three multivariate specifications with summary information in Table 4. In each of these models, we built on the finding from the univariate analysis of limited influence from the common environment, and report only AE models. The independent pathway model did not fit the data worse that the four-item Cholesky decomposition ($p$ = 0.26), while the common pathway model did fit the data worse that the Cholesky decomposition ($p$ = 0.01).

The better fit of the independent pathway model suggested that, while a common set of genes exerted pleiotropic influence on the four political sophistication phenotypes we investigated, as does a common unique environmental factor, each phenotype was also influenced by specific genes and environments. Figure 1 presents the standardized path coefficients for the common and specific additive genetic and unique environmental paths. These path coefficients echoed a finding from the bivariate Cholesky decompositions, suggesting a stronger common genetic association between formal education and political knowledge than between either of these and political interest or ideological constraint. Based on squaring and summing the relevant paths in Table 5, genetic influences account for approximately 76% of the variance of formal education, 46% of the variance of interest in politics, 60% of the variance of political knowledge, and 25% of the variance of ideological constraint. For formal education and political knowledge, most of the genetic influence is accounted for by common additive genetics, 46% and 50% respectively. Variation in interest in politics and ideological constraint are more associated with independent additive genetics, 38% and 15% respectively.

### Limitations

Our study has a number of limitations. First, we estimated a dominance model for ideological constraint because the MZ correlation was nearly six times the size of the DZ correlation. However, we did not anticipate a nonadditive model at the onset of the study, and

**TABLE 4**

Multivariate Model Comparison

| | –2LL | AIC | Parameters | Comparison model | *p*-value |
|---|---|---|---|---|---|
| 1. Saturated model | 12,566.92 | 3,412.92 | 120 | | |
| 2. Cholesky decomposition, AE | 12,675.81 | 3,321.81 | 36 | | |
| 3. Independent pathway, AE | 12,681.09 | 3,319.09 | 32 | 2 | .26 |
| 4. Common pathway, AE | 12,693.85 | 3,325.55 | 30 | 2 | .01 |

Note: -2LL=-2xLog Likelihood; AIC=Akaike Information Criterion; A=Additive genetics; C = Common environment; E = Unique environment



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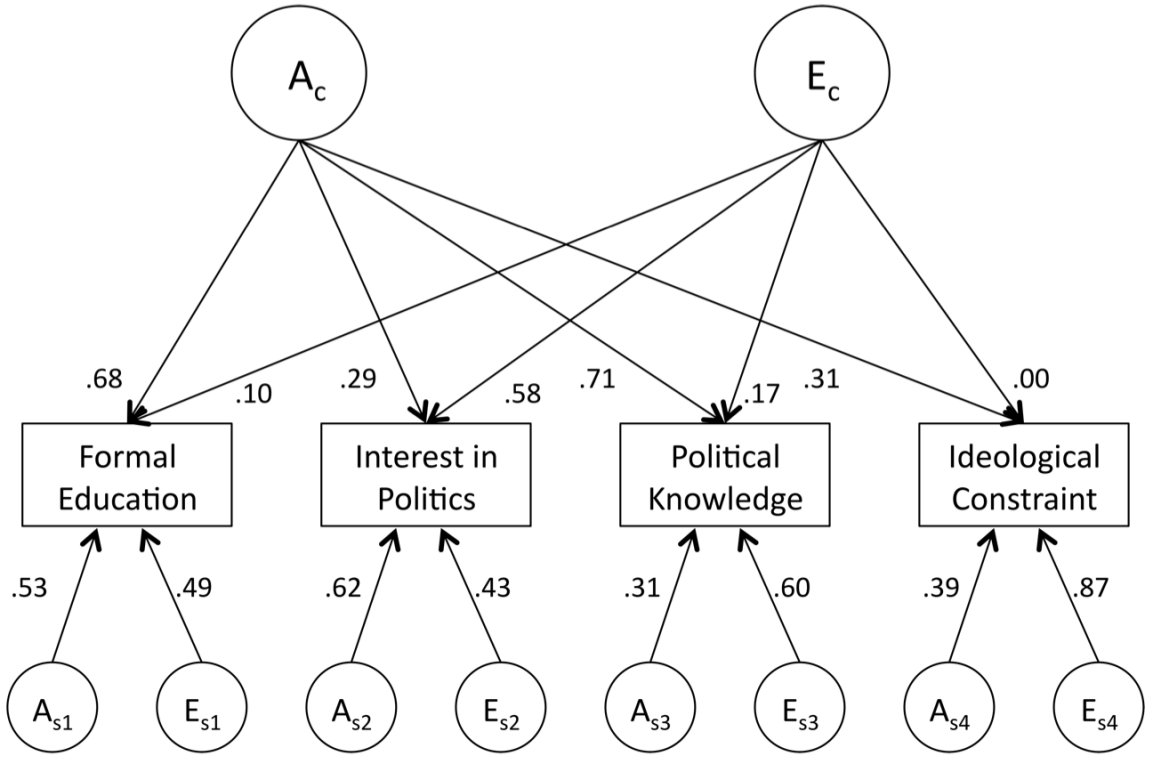


**FIGURE 1**

Independent pathway model of political sophistication measures. Values on pathways are standardized coefficients. To estimate the proportions of variance of each variable, square these coefficients.

although there may be a good theoretical rationale for it, as we discuss below, this finding is rather preliminary and requires additional research. Given the small size of the sample here (356 MZ and 240 DZ twin pairs), we lack sufficient power to discern the ADE model from the AE model. Second, we should emphasize that our sample is restricted to people aged between 52 and 61 years, which may, in part, explain why we find little evidence of any common environmental component. Moreover, the sample is skewed toward educated whites who live in central U.S.A and, overwhelmingly, in the suburbs. We may have found different results with a different population. We are also unable to speak to questions related to the development and crystallization of political ideology and sophistication. That said, this research suggests the genetic bases of political sophistication and ideology are areas for further research, replication, and extension.

## Discussion

We demonstrate that the behavioral and attitudinal facets of political sophistication are mostly explained by variation in genes and the unshared environment. Virtually none of the variance in education, political interest, political knowledge, and ideological constraint is explained by the common environment. These findings are in stark contrast to the standard social science model's emphasis on family socialization as a source of political sophistication. We also demonstrate that each of these phenotypes exhibits varying degrees of overlap in their sources. These findings corroborate previous research, which shows that each of these factors account for overlapping but distinct aspects of political sophistication. We go beyond previous research by identifying the contours of this overlap.

In particular, these data suggest that variance in education, political interest, and political knowledge is closely related. Ideological constraint exhibits some intriguing differences. Unlike the other phenotypes, which are explained to varying degrees by additive genetics, the etiology of political constraint appears to be a function of additive and nonadditive genetic factors. Moreover, we find that the bivariate correlations among education, political interest, and political knowledge are largely accounted for by genetic factors, while the correlation between ideological constraint and both interest and knowledge are largely a function of the unique environment. Finally, the multivariate analysis demonstrates that the independent pathway model best



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describes the correlations between genetic factors and the unique common environment. These findings are consistent with our expectations. To some extent, education, political interest, political knowledge, and political sophistication derive from a shared source — be it a common set of genes or a common set of environmental factors experienced in the unique environment (e.g., through the media, everyone experiences variability in the economy, the presence of partisan polarization, etc.). At the same time, these phenotypes are related but distinct, allowing room for specific genetic and unique environmental pathways.

Furthermore, these findings point to an underlying explanation for something that political scientists have long known: Ideological constraint is related to formal education, interest in, and knowledge of politics, but it is not the same thing (Weisberg & Nawara, 2010). The fact that the connection between ideological constraint and both political interest and knowledge is partly a function of the unique environment is wholly consistent with Key's observation that mass-level political belief systems are the product of an echo chamber (Key 1966). Attentiveness to politics only leads to consistent, coherent (i.e., 'constrained') belief systems if political discourse is also ideologically constrained. Consequently, one would expect the unique environment to have a sizable impact on ideological constraint.

We believe that these findings open new avenues of research into the basis of political sophistication. For example, what explains the difference between ideological constraint and the other elements of political sophistication? The need for order and coherence is a personality trait, which exhibits a considerable nonadditive genetic component (Bouchard & McGue, 2003). Perhaps ideological constraint is partially a byproduct of this personality trait. Furthermore, future research can address the limitations of this study. As powerful as the classic twin study design is, it is not possible to separate simultaneously nonadditive genetics from additive genetics and the common environment. Through an extended family design, it will be possible to estimate the various sources of political sophistication with greater precision.

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