

Theorizing Sex Differences in Political Knowledge: Insights from a Twin Study

Rebecca J. Hannagan

Northern Illinois University

Levente Littvay

Central European University

Sebastian Adrian Popa

Central European University and University of Mannheim

It is well established that women and men differ in their psychological orientation to politics (Burns, Schlozman, and Verba 2001; Dolan 2011; Fox and Lawless 2004; Thomas 2012). In addition to willingness to run for office, expressing interest in politics, and political efficacy,

The authors are listed alphabetically and contributed equally to the manuscript. We would like to thank Hermine Maes, Zoltán Fazekas, the editor, and four anonymous reviewers for their helpful feedback and suggestions for this manuscript. We also thank all the twins for participating in this study. The data employed in this project were collected with the financial support of the National Science Foundation in the form of SES-0721378, PI: John R. Hibbing; Co-PIs: John R. Alford, Lindon J. Eaves, Carolyn L. Funk, Peter K. Hatemi, and Kevin B. Smith, and with the cooperation of the Minnesota Twin Registry at the University of Minnesota, Robert Krueger and Matthew McGue, directors.

Published by Cambridge University Press 1743-923X/14 \$30.00 for The Women and Politics Research Section of the American Political Science Association.

© The Women and Politics Research Section of the American Political Science Association, 2014
doi:10.1017/S1743923X1300055X

men and women tend to differ in reporting their factual knowledge of politics, but how do we explain the gap? This question is not merely important from a measurement standpoint (e.g., Mondak and Anderson 2004) but also has implications for our understanding of gendered political attitudes and behaviors. The gap can be reduced when controlling for a number of factors, but there remains a residual when measuring knowledge with the scale most widely used. This paper aims at providing insight on how we think not only about measuring something like “political knowledge” but also how we theorize gendered political behavior. We present a behavioral genetic analysis of sex differences in political knowledge using a genetically informative twin design to parse out the source of variation in knowledge.¹ We do so predicated on a framework for thinking about gendered patterns in political behavior as well as findings from the existing literature on gender differences in the psychological orientation to politics. We believe our findings give us insight on what is wrong with current and seemingly gender-neutral measures of political knowledge.

A SOCIO-RELATIONAL FRAMEWORK

The study of political attitudes and behaviors in our discipline has historically tended to assume similarities between the sexes, even while relevant differences were being (re)discovered throughout the social sciences. Gilligan argued “theories formerly considered to be sexually neutral in their scientific objectivity are found instead to reflect a consistent observational and evaluative bias” (1982, 6). Even prior to that, Chodorow (1978, 167) suggested that girls’ psychological development resulted in their unique experiences of individuation and relationship but were not derivative of or inferior to that of boys — a notion that countered the male-centric theories dominating psychoanalysis at the time. Different does not mean inferior, according to Chodorow and others, and it seems relevant to echo such sentiments today. The assumptions we make about political behaviors and the way

1. Behavior genetic approaches have been increasingly used in political science (e.g., Alford, Funk, and Hibbing 2005; Hatemi et al. 2011a; Hatemi and McDermott 2012) and have been informative in understanding attitudinal differences between men and women (e.g., Hatemi, Medland and Eaves 2009; McDermott and Hatemi 2011) because they explain the sources of variance instead of merely comparing mean differences. Additionally, political knowledge, political efficacy, and political interest have been found to be highly heritable. But such studies did not explore potential differences between men and women (Arceneaux, Johnson, and Maes 2012; Littvay, Weith, and Dawes 2011).

we go about measuring them may reflect the “consistent observational and evaluative bias” Gilligan suggested. We contend the residual gender gap in political knowledge is an artifact of a measurement that is not gender neutral. The empirical test we present later in this article is one way to illustrate our contention, but empirical tests are not the solution. We need to think carefully about what political knowledge means, not just to scientists but to the subjects of our studies.

In political science, the measurement of attitudes and behaviors has proceeded without much reference to research outside the discipline that has identified potentially relevant sex differences. Certain attitudes and behaviors that have been theorized as epitomizing democratic citizenship are expected of both sexes, but should they be? As an example, Lazarsfeld, Berelson, and Gaudet stated the following:

Sex is the only personal characteristic which affects non-voting, even if interest is held constant. Men are better citizens but women are more reasoned: if they are not interested, they do not vote . . . [a] man, however, is under more social pressure and will therefore go to the polls even if he is not “interested” in the events of the campaign (1944, 48–49).

We think Lazarsfeld and colleagues were partially correct in their explanation that men and women perceive and engage in politics differently; however, the pressure on men to go to the polls is not the only issue. That we expect interest or knowledge to translate into reasoned action seems gender neutral, but what do we accept as political knowledge (and appropriate civic action, for that matter)?²

Fowler and Schreiber (2008) refer to our human capacity for thinking about politics as “playground cognition.” They note:

On the playground, we are figuring out whom to cooperate with and whom to avoid; we are cognizant of social hierarchy and we engage in coalitional cognition, knowing that alliance with one group will entail exclusion from another. Even at rest on the playground we are constantly monitoring our social environment and our place in it (913).

Going beyond our disciplinary boundaries, may help guide our thinking about politics. Sapiro (2003) cites that “[r]elatively little research explores

2. The notion that we expect political knowledge to translate into reasoned action (and better citizens) is cited by the following: Bartels 1996; Delli Carpini and Keeter 1996; Downs 1957, 79–80; Moore 1987; Page and Shapiro 1992; Powell 2000; Somin 2004; Sturgis 2003. The linking of “knowledge” — as measured by correct responses to a survey and to subsequent behavior such as voting for a candidate consistent with one’s values — has proven to be an erroneous assumption about how people make decisions in a wide swath of the literature linking attitudes and behavior (Druckman 2012; Jost et al. 2003; Lupia, McCubbins, and Popkin 2000; Zaller and Feldman 1992).

the impact of physiological variation associated with sex on politically relevant phenomena . . . [M]ost political psychology research involving gender focuses on socio-cultural forces” (604). Motivation to attend to politics, for example, should no longer be explained merely from the perspective of sociocultural gender role expectations like the pressure men of Lazarsfeld’s time felt that drove them to go to the polls more than women. This motivation also involves consideration of patterns of emotionality in affiliative and avoidant behaviors, for example, as consistent with “playground cognition.” We then need to connect such motivations to the articulated values and actions of citizens.

The most basic expression of emotionality is the motivation to respond to socially relevant stimuli. Social contexts elicit affiliative and avoidant responses very fundamentally, and scholars argue there is form and functionality associated with gendered patterns of approach and avoidance. Women tend to have greater sensitivity to social and emotional cues of capacity and trustworthiness and tend to signal trustworthiness (e.g., kindness, sympathy, integrity) more than men who tend to signal capacity (Geary 2009; Vigil 2009). These general patterns are argued to be a result of a long human history of men and women using different strategies to get what they need to survive in complex and changing social contexts. Further evidence of this is the unique perceptual, neuroendocrine, and expressive biases that underpin approach and avoidance behaviors. These underpinnings differ between men and women in various sociorelational contexts, including politics (Geary 2009). They also carry different meanings for people in the contexts in which they live.

Research suggests women’s greater prosociality is the result of a long human history of male-biased philopatry, where women dispersed to live with nonkin. Where women have had to be (or are still today) reliant on nonkin or distantly related kin, more sociorelational maintenance behaviors for ensuring reciprocity would have been (or are) necessary (Geary 2009; Hrdy 2009; Low 2000). Studies from social psychology illustrate women’s preference for particular social arrangements that facilitate reciprocal trust cues — women tend to form and maintain smaller networks or groups than men. Experiments from psychology, experimental economics, and political science show that women are more interpersonally oriented, avoiding overt hierarchies, and men are more group oriented and gravitate to hierarchies (Baumeister and Sommer 1997; Eckel and Grossman 1998; Gabriel and Gardner 1999). Further, men tend to engage in competitive between-group interactions more than women (Niederle and Vesterlund 2007; Pemberton, Insko,

and Schopler 1996; Van Vugt, De Cremer, and Janssen 2007). These social psychological capacities are not distinct from politics, but rather underpin men and women's orientation to politics. In many ways, they are politics.

Those sociorelational differences between men and women underpin many complex social behaviors. For example, men's achievement goals may be predicated on mastery of a task and separating themselves from others and further directed at the use of status and power. Even if in subtle ways, if competition and status are cued, men may respond in ways distinct from women. Women's goals, alternatively, may be predicated on affiliative outcomes or setting themselves in harmony with others (Gaeddert 1985; Geary 2009). Stress responses in anticipation of events further reinforce these findings. Men tend to produce greater stress response to events that display capacity (e.g., public demonstration of intelligence) whereas women's stress systems tend to be more sensitive to social exclusion (Stroud, Salovey, and Epel 2002). These findings articulate general patterns, and, as with any trait or characteristic, we expect to see variation both between and within the sexes, though most studies stop at merely identifying mean differences between men and women.

The framework that we propose to guide research on gender and political behavior involves the dynamic interaction of individual physiology, psychology, and sociorelational processes that give rise to specific political behaviors consistent with "playground cognition." Smith et al. (2011) presented a theoretical framework for thinking about the influence that genes have on political attitudes. They demonstrated that the influence is quite indirect, and the levels of analysis between genes and behavior include relevant biological systems, neurological bases of information processing and cognition, personality and values, and ideology (Smith et al. 2011).³ This perspective suggests influences on individual behavior arise from *both* external social influences and internal psychophysiological processes but what truly drives behavior are the meaning and values of individual orientations to socio-relational contexts. We would add that external sociorelational contexts may influence men and women differently. Their model may have been put forth as gender neutral, but if we want to proceed as a predictive social

3. The authors also note that even this model is overly simplified but illustrates the multiple levels of modeling that would need to be undertaken in order to truly understand the impact of genes on complex political behaviors.

science (as opposed to one that is merely descriptive), sex differences must be considered. The framework we propose to guide our thinking about modeling sex differences adapts elements from Smith et al. (2011) and is presented in Figure 1.

To explain briefly how Figure 1 may be useful in guiding research on political behavior with an eye to sex differences, consider that the realm of understanding sex differences in political science research exists largely within the last two boxes on the far right of the diagram: Political Ideology and Specific Political Attitudes. We understand them as influenced by the Environment but as typically neglecting influence from the boxes on the left (as Sapiro reminds us in the quote cited above). The puzzle of the knowledge gap, which we discuss in the next section, is a case in point. Much of the gap has been empirically reduced by taking account of changes in environmental variables (e.g., level of education), but what of the residual gap? Perhaps moving to the categories on the left side of the diagram can provide insight. For example, how do men and women perceive the "political" aspects of their lives? And how do their values influence what motivates them to act?

In the next section we review the empirical findings to date regarding a "gender gap" in political knowledge. We then present an empirical test utilizing a twin study as a way to examine the potential source of the variation in political knowledge between men and women that may provide insight into what we are not accounting for in current measures. We conclude with a discussion of our findings in light of our theoretical framework.

WHITHER THE GENDER GAP IN POLITICAL KNOWLEDGE?

Dolan (2011) cites, "That women exhibit lower levels of political knowledge than men is a common and consistent finding in political science research" (97), but a series of studies have identified measurement nuances and intervening variables that greatly decrease (and even reverse) the gap.⁴ We argue here that the statistical tests to date explain the reduction in the gap, but the source of the gap that remains is yet to be understood.

4. Political knowledge has been defined as "factual knowledge about institutions and process of the government, current economic issues and social conditions, the major issues of the day, and stands of political leaders on those issues" (Delli Carpini and Keeter 1996, 1).

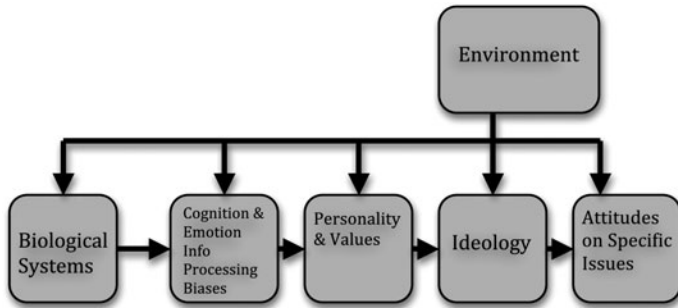


FIGURE 1. Socio-relational framework of biologically relevant systems, information processing bias, personality/values, ideology, and specific political behaviors (adapted from Smith et al. 2011).

The notion that men are more knowledgeable has been brought into question by their greater propensity to guess in response to survey questions as opposed to selecting a “don’t know” response (Mondak and Anderson 2004).⁵ Lizotte and Sidman (2009) found that in 11 of the 12 surveys they administered, women were 1.5 times more likely to choose the “don’t know” response. The authors find that models accounting for the inclination to say they “don’t know” produce knowledge estimates for women that are much closer to, and sometimes exceed, the estimates for men. Further, stereotype threat produces relatively lower levels of reported political knowledge for women as contrasted with men when such threats are absent. For example, when the survey was presented as nondiagnostic and when the interviewer was female, female respondents achieved higher accuracy (McGlone, Aronson, and Kobrynowicz 2006). Such findings are consistent with what we might expect given the response to complex sociorelational contexts. When competition is cued, men perform better and women’s performance decreases.

The *ability* to retain learned information, *opportunity* or access to the information in the first place, and *motivation* or interest in politics (Delli Carpini and Keeter 1996; Luskin 1990; Popescu and Tóka 2009) have all been cited as important pieces of the constellation that is political

5. The Mondak and Anderson (2004) article illustrated that the knowledge gap was largely a feature of how political knowledge is measured in survey instruments. In short, they found that men are more likely to guess on political knowledge questions. Guessing leads to the appearance of greater knowledge, thus creating the empirical “gap.” By randomly assigning “don’t know” responses, the gender disparity decreased by about 50%. The authors, however, were not able to ascertain the source of the remainder of the gender gap.

knowledge and have been assessed individually for their specific role in explaining the gap.⁶ *Ability* has been operationalized as level of education or type of education (i.e., civics). In most of the studies that take education into consideration, the gender gap is largely reduced (Burns, Schlozman, and Verba 2001; see also Lay 2011 for an example of knowledge favoring women and girls). Closely related to ability is *opportunity*, which refers to the availability of information in a certain context (Delli Carpini and Keeter 1996; Luskin 1990; Popescu and Tóka 2009). Where women have greater access to political information, they tend to do as well as men in response to knowledge questions (Burns, Schlozman, and Verba 2001). In other words, the gap is reduced when education and opportunity are controlled for.

Motivation seems to be the critical area in examining the gender gap in political knowledge. Verba, Burns, and Lehman Schlozman (1997) demonstrate that women are less politically interested than men, echoing Lazarsfeld, Berelson, and Gaudet (1944). They refer to this as the “engagement gap” and argue that such gender differences seem to be specific to politics and not a result of general personal attributes.⁷ However, Karp and Banducci (2008) find that the presence of women as candidates and office holders can stimulate political engagement among women (see also Campbell and Wolbrecht 2006).

Dow (2009) finds that similarly situated men and women (i.e., controlling for SES [ability], working outside the home [opportunity], etc.) may invest the same in obtaining political knowledge, but men get a different return on investment than women. Using American National Election Studies (ANES) data, Dow finds that at least two-thirds of the gap in political knowledge results from differences in returns on investment in obtaining political knowledge. This also squares with why men are more inclined to guess. They get a different sociorelational “reward” (so to speak) than women would by doing so. We argue that if the “knowledge” men and women invested in was doing something that motivated women the way the current knowledge questions appear to motivate men, this same conclusion could be drawn, instead favoring women.

6. Other factors, such as age, living in a city as opposed to living in a rural area, strength and direction of partisan attachment, and frequency of political discussion are also linked to the ability-motivation-opportunity triad and have been shown to have an impact on the level of political knowledge (Baum and Jamison 2006; Delli Carpini and Keeter 1996, 179; Luskin 1990; Popa 2013; Popescu and Tóka 2009; Zukin and Snyder 1984).

7. This observation appears to be empirically true for women running for office as well (see Fox and Lawless 2004) and, instead of the “engagement gap,” has been referred to as the “ambition gap.”

As it turns out, this is precisely what happens. When the knowledge questions concern government services and programs (Stolle and Gidengil 2010; Thomas, Harell, and Gosselin 2013) or on women's representation in national government (Dolan 2011), the gender gap in political knowledge is substantially reduced to the point that women and men have similar levels of knowledge, or the gap favors women. In short, the traditional way of measuring knowledge is tapping something that motivates men (both to attend to the information in the first place but also to guess) but not as much for women. According to our framework, we would argue that the sociorelational *benefit* to knowing about how many votes it takes to overturn a presidential veto is different for men and women. As long as such questions are the measure of knowledge that counts as "knowing about politics," women as a group are likely to elicit less knowledge in addition to less efficacy than men as a group.

These above-cited studies appear to converge on a common theme. The gap in political knowledge can be greatly reduced by accounting for ability and opportunity, which is addressed by theorizing about the changing role of women in society, but also by measurement manipulations such as the absence of stereotype threat and discouraging guessing. We believe our sociorelational framework assists in explaining why each of these manipulations reduces the gap. What seems to be underpinning the residual gap is something particular to the type of questions asked (as illustrated by the Stolle and Gidengil and Thomas, Harell, and Gosselin studies). Are the seemingly gender-neutral questions that measure political knowledge actually biased? We believe the findings of our empirical test suggest as much.

In the next section we present an empirical test for the sources of variation in response to the traditional battery of political knowledge questions via a twin study. Twin studies have been employed by behavioral geneticists since the 1970s to explore the sources of variation in social and political attitudes (Eaves and Eysenck 1974, Martin et al. 1986). It has only been in the last decade that political scientists adopted this method (e.g., Alford, Funk, and Hibbing 2005). Political reasoning (or thinking about politics), unlike subjects taught in the classroom such as mathematics or other matters involving complex reasoning, is neurologically more similar to other forms of social reasoning. Again, "playground cognition" is a better way to conceptualize how most people think about politics. Fowler and Schreiber (2008) argue that "[w]hen people . . . are asked for judgments of political issues," they utilize the

same parts of the brain as when thinking about solving social situations; “such findings suggest that political thinking is akin to social cognition” (914). We take this a step further and argue that because what matters socially often differs for men and women, political thinking does as well.

A twin study provides one way to examine the gender gap in political knowledge by considering the sources of individual variation on a trait (such as responses to a battery of political knowledge questions) instead of merely focusing on mean differences between men and women. Since social forces largely diminish the “gap” or mean differences, our test of variance can look at what is driving the differences. If differences in variance are due to additive genetic influences, this provides a different path for thinking about the residual gap as opposed to the status quo where discrepancies are assumed to be derived solely from environmental or societal factors.

A twin study is possible because there are individuals who differ in their genetic similarity — monozygotic (MZ) twins, who are genetically identical, and dizygotic (DZ) twins, who share roughly 50% of the genes transmitted from their parents — but who grow up in the same environment. Variation in complex traits (i.e., political knowledge) can be parsed out via variance components modeling or via genetic and environmental influences (Medland and Hatemi 2009). Correlations can be made between the two types of twins on the trait of interest, in this case responses to the political knowledge questions. If MZ twin correlations are much higher than those of DZ twin pairs, this suggests the presence of additive genetic influences.

Correlations do not suffice, however. Figure 2 depicts the basic path model for twin resemblance. The test that remains is to assess which combination of additive genetic influences (A), common environmental influences (C), and unique environmental influences (E) best fit the data. In other words, the combination of parameters (ACE, AE, CE, or E) must be determined to be the most parsimonious explanation for the patterns of MZ and DZ twin pair correlations (Hatemi et al. 2011a, 12). We perform this analysis and report the results in the following section.

DATA AND METHODS

The data come from a study of social and political attitudes collected in 2008–2009 administered to a sample of twins selected from the Minnesota Twin Family Registry. The Minnesota Twin Family Registry

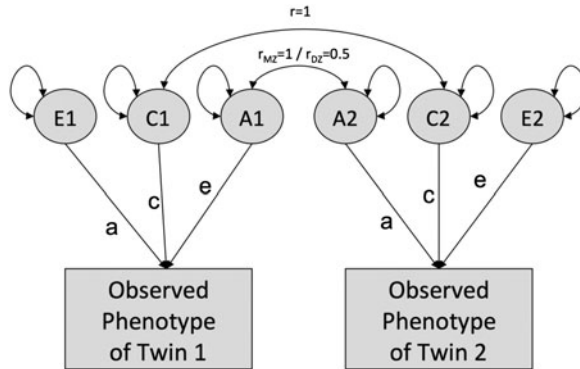


FIGURE 2. ACE twin design. A = [A]dditive genetic effect; C = [C]ommon Environmental Effect; E = Unique [E]nvironmental Effect for Twin 1 and Twin 2.

is comprised of about 8,000 twin pairs born in the state of Minnesota between 1936 and 1955. The registry was compiled between approximately 1983 and 1990 (see Krueger and Johnson 2002 and Lykken et al. 1990 for additional information on the Minnesota Twin Family Registry).

The Minnesota twin study of social and political attitudes is the first twin study specifically devoted to the subject matter. The mode of data collection was a web survey that was fielded between July and December of 2008 with a supplementary collection effort using a self-administered paper-and-pencil questionnaire between July and October of 2009. Given the characteristics of the Minnesota Twin Family Registry, the sample is restricted in its age coverage. All respondents were between the age of 53 and 61 at the time of the interview. Only same-sex twin pairs were selected in the sampling phase. $N = 1349$ interviewed individuals yielded $n = 596$ matched twin pairs (MZ Males = 143 pairs, MZ Females = 213 pairs, DZ Males = 86 pairs, DZ Females = 154 pairs).⁸ The sample also included 157 twins whose cotwin data were missing. Item and unit-missing data still produced coverage over 80.8% in the covariance estimation for the structural equation model.

The dependent variable, political knowledge, is operationalized using the 5-question, multiple-choice quiz (this operationalization is widely used in the research cited above and is the basis for claiming the

8. Throughout the article, monozygotic, or identical twins, will be abbreviated as MZ, and dizygotic, or fraternal twins, as DZ.

existence of a gap) by adding up correct responses adding up to a 6-point knowledge scale. Incorrect responses, “not sure” responses, and missing responses on some the knowledge questions were marked as wrong and summed to produce the knowledge score.⁹ For respondents who failed to fill out any of the knowledge questions, overwhelmingly due to incomplete questionnaire with the knowledge questions near the end, we marked as missing. The questions can be found in the Appendix.

ANALYSES

All analyses to explore the data were conducted with Mplus using each individual (not pair) as an observation and always correcting for the nonindependence of twins from each other through cluster sampling correction.¹⁰ The average respondent got 3.539 questions correct with a variance of 2.321. The age and sex corrected mean difference for MZ and DZ twins is -0.001 ($p = 0.993$). Age and sex corrected variances are $MZ = 2.166$, $DZ = 2.185$ (where the p -value for the difference is $p = 0.906$). Male and female variances of knowledge differ more substantially (male = 1.607, female = 2.513; male-female, $p < 0.001$) suggesting that separate treatment of males and females is warranted when decomposing the variance into additive genetic, common, and unique environmental effects. The means are also significantly different; women get 0.765 fewer questions correct ($p < 0.001$). Despite the highly restricted variance of age in the sample, a year increase in age will lead to a correct answer on 0.031 more questions ($p < 0.1$). This coefficient needs to be interpreted with caution to ensure that no inferences made outside of the sample’s age range of 53 and 61. Since age is still a significant predictor, age is corrected for in subsequent analyses.

To decompose the variance in political knowledge we use a structural equation ACE model. Due to space restrictions, we offer only a brief summary of the model. For a more extensive discussion please see Medland and Hatemi (2009).¹¹ In the ACE model, the variance of the dependent variable is decomposed into additive genetic (A), common

9. We treat “not sure” similar to incorrect answers (see Luskin and Bullock 2011; Sturgis, Allum, and Smith 2008).

10. Muthen and Muthen 2008.

11. We also recommend referring to the authoritative work by Neale and Maes (2004), *Methodology for Genetic Studies of Twins and Families*. <http://ibgwww.colorado.edu/workshop2004/cdrom/HTML/book2004a.pdf> (accessed December 10, 2013).

environmental (C), and unique environmental (E) effects using a structural equation model that treats these components as latent variables. Given the use of a genetically informative twin sample, we know that additive genetic effects are perfectly correlated for MZ cotwins and, on average, 0.5 correlated for DZ cotwins. Common environment is perfectly correlated for both MZ and DZ cotwins while the unique environment is uncorrelated across the twin pairs. For a visual representation of this structural equation model, again, see [Figure 2](#). This structural equation model is estimated using maximum likelihood. Alternative models are then compared.

The classic two-group model where MZ twins constitute one of the model groups and the DZ twins constitute the other can be extended into a four-group model that also separates the groups by sex. The classical two-group model assumes equal additive genetic, common, and unique environmental contribution to the variance for both males and females. It also assumes equality of variance in the dependent variable for males and females. The utilization of this more complex four-group model is necessary since both the means and variances for knowledge are different between sexes, and therefore we expect that the effects of A, C, and E may also be different.

Just like with the two-group model, where certain parameters of the model can be fixed and the fit of the more parsimonious model tested, the same is possible with the four-group model. In addition to fixing certain parameters to zero, proportions or absolute sums of the variance explained by the different sources can also be equated between sexes. The following section presents the fit of the full and reduced models.

RESULTS

We start model fitting through comparing the four-group saturated model that does not decompose the variance to the ACE components that estimates different additive genetic, common, and unique environmental effects for males and females separately. (See [Table 1](#) for model fitting.) The p-value for the difference in model fit is within a 4-decimal rounding error of 1 suggesting, it is appropriate to use the ACE model. Since C is estimated at 0, we move to an AE model that fixes the C component at 0. This also does not deteriorate the fit significantly ($p = 0.84$). We then equate the unstandardized A and E variance

Table 1. Saturated and ACE model fit statistics

<i>Comparison to the ACE model</i>	<i>-2LL</i>	<i>df</i>	<i>p-value</i>
4 Group ACE Model	8993.792		
4 Group AE Model C = 0	8994.142	2	0.8395
AE M = F for A	9004.226	3	0.0152
AE M = F for E	8997.062	3	0.3518
AE M = F for A and E	9018.944	4	0.0000
<i>Comparison to the AE model</i>	<i>-2LL</i>	<i>df</i>	<i>p-value</i>
4 Group AE Model	8994.142		
AE M = F for A	9004.226	1	0.0015
AE M = F for E	8997.062	1	0.0875
AE M = F for A and E	9018.944	2	0.0000

Note: Best-fitted model bolded; Chi-square difference in fit between the saturated model and 4 group ACE model is insignificant at $p > 0.9999$.

components across the sexes individually and jointly. Equation of the E component leads to an insignificant decrease in fit ($p = 0.0875$) while fixing the A or jointly fixing the A and E components equal to each other across the sexes deteriorates the fit significantly ($p < 0.01$ and $p < 0.001$, respectively).

In essence, this means that the amount of the variance explained by the environment (E) is the same for men and women. But there is a difference in the variance explained by additive genetic effects (A). The difference in variance for men and women comes from additive genetic sources and not environmental sources. It is also important to highlight that variance in political knowledge does not appear to be influenced by socialization sources (C).

Medland and Hatemi (2009) criticized model reduction for small samples specifically in the context of fixing a variance component to 0. Their arguments could easily apply to equating parameter estimates across the sexes. We agree with Medland and Hatemi's arguments because with small samples it is always more difficult to detect actual differences (between sexes or from a 0 estimate), and fixing parameters might only seem to work for good-fitting models because they lack the power to detect actual differences. In other words, fixing components of the ACE model to 0 because they are not significant is inappropriate when the sample size is small and the reason for the lack of significance is the lack of power and not because the effect is close to 0. The best way to overcome this is to estimate an insignificant component regardless. It

leads to less power and wider confidence intervals but to more trustworthy results, especially with small samples.

In light of these potential concerns, we present the complete results for every model that is less restricted than the final best fitting model identified during the model fitting process. Based on those results depicted in [Table 2](#), it is clear that no matter which model we run, we are consistently yielding similar results (although confidence intervals do get narrower with the more restricted models). Every parameter that is significantly different from 0 in the most restricted ACE model is also significantly different from 0 in the least restricted model. The qualitative magnitudes of the parameter estimates also do not change substantially.

While past studies within political science focus predominantly on the standardized proportion of variance attributed to additive genetic, common, and unique environmental components, given the differences in total trait variance across the sexes, the unstandardized components are more telling in our case.¹² For reference, [Table 2](#) presents both standardized and unstandardized results. The amount of variance unique environmental effects is responsible for is practically the same for men and women. There is a sex difference, however, in the amount of variance additive genetic effects is responsible for. In fact, additive genetic effects seem to drive the difference in variance almost entirely.¹³

Beyond the difference in variation, there is also a mean difference present between sexes. Based on the available information, we can only speculate what contributes to the differences in the means, but seeing that most of the people in the sample got all knowledge questions right serves as a guide. Since the unique environmental contributions

12. Standardized components add up to 1 (or 100%), whereas unstandardized components add up to the total variance. In behavior genetics the use of unstandardized component is very common, as it is more informative (see, for example, Neale and Maes 2004, 166). The advantage of standardized results is that it is easier to understand, hence, its popularity in political science where twin studies are considered to be new still. But one of the limitations of using the standardized components is that the results are inaccurate when the variances are different between the groups studied (in our case, men and women). In fact, when the variances are different between groups, as they are in our analysis, it makes little sense to use the standardized results, as it equates unequal variances in the process of standardization leading to misleading results.

13. Sensitivity analysis showed that no single item drove this result. While item by item analysis was not possible (since dichotomous items do not have variance, hence having to equate men to women when using a probit link function), we did test what happens when we exclude one question from the scale, testing all combinations. Results did not show drastic variance, but this is no surprise, as none of the questions are in line with what, for example, Stolle and Gidengil (2010) argue to use to minimize the gender differences in the means. Based on the evidence presented, we argue that their argument extends to the variance as well.

Table 2. Twin variances, co-twin covariances, correlations and A, C and E variance decomposition with 95% confidence intervals

	vMZ Male	vMZ Female	Age Effect	rMZ Male	rDZ Male	rMZ Female	rDZ Female	A Male	C Male	E Male	A Female	C Female	E Female
Saturated Model	1.612	2.509	0.032+	0.805***	0.162	1.397***	0.813***						
Unrestricted ACE	1.612	2.509	0.032+	0.767***	0.384***	1.398***	0.813***	0.767 (0.45–1.12)	0 (0–0.69)	0.85 (0.62–1.13)	1.17 (0.23–1.68)	0.228 (0–1.03)	1.111 (0.88–1.39)
AE Model C = 0	1.617	2.503	0.03	0.767***	0.384***	1.409***	0.704***	0.767 (0.49–1.09)	–	0.85 (0.63–1.13)	1.409 (1.10–1.70)	–	1.095 (0.87–1.35)
AE M = F for E	1.656	2.48	0.03	0.658***	0.329***	1.482***	0.741***	0.658 (0.39–0.92)	–	0.999 (0.83–1.19)	1.482 (1.22–1.75)	–	0.999 (0.83–1.19)

Note: Twin variances, unstandardized age effect, co-twin covariances and unstandardized A, C and E variance decomposition with 95% confidence intervals in parenthesis.
 +p < 0.1, *p < 0.05, **p < 0.01, ***p < 0.001

	Std. Var. Male	Std. Var. Female		rMZ Male	rDZ Male	rMZ Female	rDZ Female	A Male	C Male	E Male	A Female	C Female	E Female
Saturated Model	1	1		0.499***	0.1	0.558***	0.325***						
Unrestricted ACE	1	1		0.474***	0.237***	0.558***	0.325***	0.474 (0.29–0.63)	0 (0–0.43)	0.526 (0.38–0.68)	0.466 (0.09–0.64)	0.091 (0–0.42)	0.443 (0.35–0.56)
AE Model C = 0	1	1		0.474***	0.237***	0.564***	0.282***	0.474 (0.32–0.62)	–	0.526 (0.38–0.68)	0.563 (0.46–0.65)	–	0.437 (0.35–0.55)
AE M = F for E	1	1		0.397***	0.199***	0.598***	0.300***	0.397 (0.27–0.52)	–	0.603 (0.48–0.73)	0.597 (0.51–0.67)	–	0.403 (0.33–0.49)

Note: Standardized age effect, co-twin correlations and standardized A, C and E variance decomposition with 95% confidence intervals in parenthesis.
 +p < 0.1, *p < 0.05, **p < 0.01, ***p < 0.001

between the sexes are the same, it suggests that the differences in the additive genetic components are forcing the mean political knowledge downward for females in presence of a ceiling effect produced by a low number of relatively easy questions asked.¹⁴

LIMITATIONS

One limitation of the ACE model is that it tests the impact of certain sources on the variance, not the mean. Reasonable questions could arise: What is the source of the difference in means between men and women? Is the difference in means due to genetic differences? We cannot definitively answer this question with the data we have available to us in the Minnesota Twins Political Survey. To pursue an answer to this type of question, we would need to explore the impact of potential sex chromosomes (Hatemi, Medland, and Eaves 2009) or differential functioning of specific genotypes across men and women. Such differences or differential functioning are unlikely to answer our questions.

The analysis does come with limitations provided by the data and assumptions made by the model.¹⁵ The Minnesota Twins Political Survey is one of the first sources to provide detailed political data collected on a twin sample. Unfortunately, this sample is heavily restricted by age and geography, and we have little information as to how these results would generalize to other age groups and people from different areas of the country. Also, the sample is relatively small. This is one of the reasons DZ cotwin correlation statistics might be insignificant, rendering the classical twin model unreliable. Further, males in the sample are underrepresented, though this is not uncommon for twin samples. Additionally, various survey behaviors, such as nonresponse or response biases, can also be heritable, producing additional confounds to our study (Littvay 2010; Littvay, Popa, and Fazekas 2013; Thompson, Zhang, and Arvey 2011).

Finally, the presented twin models cannot rule out the possibility of an omitted variable bias. It does not take into account interaction effects both within and across the A, C, and E components, and the best-fitting AE

14. In addition, we reanalyzed the data considering anyone who had a single “not sure” response to any of the knowledge questions as missing data. This only inflated the reported sex differences. The results we present hold under these circumstances and, in fact, become more pronounced when the difference between male and female heritabilities are concerned.

15. The latter is discussed in detail in Medland and Hatemi (2009), but see also Littvay (2012) for why some of these are not of substantial concern.

model assumes that C is 0. While we know that the AE model shows superior model fit statistics compared to the ACE model, with a much larger sample it is possible that a significant C component would be detected and a more nuanced picture could be drawn, fine-tuning the exact proportions of contribution to the total variance. The omission of gene-by-gene and gene-by-environment interactions can also bias the results, though Verhulst and Hatemi (2013) suggests this bias is negligible.¹⁶

DISCUSSION

Our empirical findings suggest that the environment is not the sole source driving the differences, but rather that the differences stem from variation driven by heritable factors when using a conventional scale for measuring political knowledge. We address our findings in this section in two ways. First, we articulate what the findings of our analyses do not mean. In light of this, we argue that the concept and subsequent measurement of political knowledge itself contains a gender bias that is tapping something that is driving the difference (i.e., lesser variance for men as compared to women). Second, we discuss how researchers should think about and measure political knowledge (see Stolle and Gidengil 2010; Thomas, Harell and Gosselin 2013), and we hope to set the stage for more nuanced approaches to studying gender and political behavior.

The preceding analysis suggests that the variance explained by the environment is the same for men and women. There is, however, a difference in the amount of variance explained by additive genetic effects. This finding is potentially controversial, but we want to caution readers not to interpret “amount of variance explained by additive genetic effects” as “caused by genes.” Twin studies do not test for a direct genetic causal relationship. They are a tool to identify presence of heritability. We do this not to pronounce that men are “genetically inclined to X . . .” or “women are genetically inclined to Y . . .” but to illuminate the possibility that the way we have been thinking about and measuring political knowledge might be gender biased, as our test illustrates that the current scale widely used for measuring political knowledge elicits more than mean differences. It elicits greater variance for women and less variance for men.

16. But see also Shultziner's essay on the topic (2013).

Interpretation of our results suggests the variation among women is being driven by additive genetic effects as opposed to environmental sources, which is what the literature to date has pointed to as the causal mover of the knowledge gap (e.g., the more education and access women have, the better they perform on the knowledge questions). We again caution the reader not to misinterpret our findings. To think about this in a more nuanced way and in a way that we hope might inform future measurement of political knowledge, we now turn to the notion of variance in political knowledge being *heritable*. What could that possibly mean?

A finding such as the one presented in this paper raises an important theoretical question: Why would the additive genetic component influence variation in women's political knowledge more than men's? To respond to this question, we draw on recent studies that have considered heritability and a gender gap. When there is a difference in heritability between men and women on a trait with more variation in one sex but not the other, there may be adaptation involved — or something in the psychological or behavioral trait that is relevant for survival and reproduction to one sex but not the other. Hatemi, Medland, and Eaves (2009) cite that the genetic variation will be *less* for traits exposed to stronger selection. Logic would have us predict *lower* variance on the heritable trait since things that matter most for survival and reproduction are most tightly regulated. So the key interpretation of this difference has less to do with a greater variance in political knowledge for women and more to do with this particular measure of political knowledge tapping into something that is particularly salient for men. Consistent with “playground cognition,” we attend to those aspects of social and political life that are most likely to serve us well. We do not need a genetic test to understand that. We could simply ask people what is important and why.

What the literature on the knowledge gap cited above converge upon is the notion that men and women are more or less likely to be motivated to attend to various kinds of political knowledge given the relative “return on investment.” We suggest the “return on investment” can mean anything from the social acceptability of reporting you “don't know” on a test of knowledge, cueing competition and hierarchy, or the extent to which spending time learning one type of political knowledge over another is likely to bring about practical social and material benefits.

Lizotte and Sidman (2009); McGlone, Aronson, and Kobrynowicz (2006); and Mondak and Anderson (2004) all illustrate differing forms of

risk-taking or risk-averse behaviors and find changes in the knowledge gap accordingly. In addition to the “propensity to guess” research, perhaps the most important clues regarding political knowledge and the gender gap come from Stolle and Gidengil (2010), who illustrate that “politics” is not merely the campaign horse races, the who’s who of office holders, and other civics quiz-type questions. Politics is also about goods and services, access, and identifying contexts when one’s views are more likely to be represented.¹⁷ Women are as, if not more, knowledgeable as men about these aspects of politics (see also Dolan 2011; Karp and Banducci 2008). Although women are nearly as likely to correctly respond to the knowledge questions when controlling for education, SES, and so forth, there remains a gap that is remedied by changing the nature of the questions. Unfortunately, our data does not allow us to run the analyses using those “practical” knowledge questions, but we hope that providing our framework for thinking about why there may be differences and what types of questions may tap a gendered response will encourage others to further investigate this hypothesis.¹⁸

Based on our sociorelational framework, men and women may attend to different types of information in varying social contexts and in response to the affiliative or capacity-driven consequences. Thinking about these differences may assist in better predicting attitudes and behaviors. And returning to Chodorow (1978), Gilligan (1982), and Saprio (2003), such findings need not result in men’s focus of attention or resulting behaviors being more valid than women’s. Measuring “political knowledge” could arguably be undertaken in a number of different ways. We may understand politics to be about the operation of government and how power is distributed, but also to be about the distribution of goods and services and even the relationship between citizens and government (e.g., Thomas, Harell, and Gosselin 2013). We encourage the reader to think more broadly about the questions measuring political knowledge in their survey instruments. Political knowledge, as presently measured in the traditional battery of questions, is all about the contest, the hierarchy, and power. Politics so defined may be particularly salient for men because they get a greater sociorelational return on investment for

17. For another treatment of this idea, see Hannagan 2008.

18. Examples of “practical” political knowledge questions (from Thomas, Harell, and Gosselin 2013) include the following: (1) “If someone is working in Canada and has to take care of a seriously ill relative, how many weeks of compassionate care benefits are paid?” (2) “Imagine someone is trying to rent an apartment in Calgary. If they were refused an apartment and thought it was because they were a student, where would be the best place to go to make a complaint?” (3) “If someone had to go to court and could not afford a lawyer, where would be the best place to go?”

knowing about these aspects of politics. Women may be more likely to have a greater psychological orientation to other aspects of politics, such as services and policies impacting their communities and their families (Stolle and Gidengil 2010; Thomas, Harell, and Gosselin 2013), as well as to whom they may look to for furthering their political interests the best.

We use statistics in the social sciences to tell a story. The story we are telling is that these particular questions measure an aspect of politics that resonates with men's psychological orientation more than an aspect of politics that would resonate with women's. Change the "cueing" of that orientation, and you change knowledge reports as well as related behavior. Due to the limits of our data and methods, we cannot directly test this hypothesis, but we hope to see other scholars and engage this inquiry further using more appropriate data and methods.

Politics is about the ability to identify and negotiate for what you need within the spheres of political exchange in which you operate. There are good reasons for these spheres to be perceived somewhat differently by men and women and for their strategies in attending to information to be different as well. Madeleine Kunin, a former ambassador and governor of Vermont, described her experience of entering "politics" the following way:

I was unknowingly preparing for a political life . . . None of the activities I engaged in met the definition of "political," but they taught me political skills. The difference between community activities and political action is simply one of scale . . . When I was eventually elected to public office, I discovered I was far better prepared than I had anticipated. I had underestimated the enormous amount that I had learned in the community and was unaware of my ability to transfer my knowledge to public life (as cited in Mayhead and Marshall 2005, 74).

Kunin did not realize what she was doing was political or had any transference to "politics" because it did not match up with the prevailing conception of political behavior and politics. Her perception of what needed to be attended to and her motivation to make it happen was political behavior. When we begin asking women (and men) about their communities and things that immediately matter for their well-being and how they negotiate for those things. We will better understand the relationship between political knowledge and modes of citizenship that include many aspects of political behavior. As Mondak and Anderson (2004) state, "it makes no sense to seek out a reliable scale that measures

the wrong thing . . . reliability is desirable only as a means toward validity, not as a substitute for validity” (507).

Widespread assumptions about men’s and women’s political behavior are ripe for reconsideration, and research pertaining to women’s political behavioral repertoires requires a multidisciplinary approach. We strongly advocate for further investigations pertaining to gender differences in political attitudes and behaviors that employ more nuanced theoretical frameworks to inform empirical analyses.

Rebecca J. Hannagan is Associate Professor of Political Science at Northern Illinois University, DeKalb, IL: rhannaga@niu.edu; Levente Littvay is Assistant Professor of Political Science at Central European University, Budapest, Hungary: littvayl@ceu-budapest.edu; Sebastian Adrian Popa is a Ph.D. candidate at the Political Science Department at Central European University and a Researcher at MZES, University of Mannheim, Mannheim, Germany: Sebastian.Popa@mzes.uni-mannheim.de

REFERENCES

- Alford, John R., Carolyn L. Funk, and John R. Hibbing. 2005. “Are Political Orientations Genetically Transmitted?” *American Political Science Review* 99 (2): 153–67.
- Arceneaux, Kevin, Martin Johnson, and Hermine H. Maes. 2012. “The Genetic Basis of Political Sophistication.” *Twin Research and Human Genetics* 15 (1): 34–41.
- Bartels, Larry M. 1996. “Uninformed Votes: Information Effects in Presidential Elections.” *American Journal of Political Science* 40 (1): 194–230.
- Baum, Matthew, and Angela S. Jamison. 2006. “The Oprah Effect: How Soft News Helps Inattentive Citizens Vote Consistently.” *The Journal of Politics* 59 (2): 946–59.
- Baumeister, Roy F., and Kristin L. Sommer. 1997. “What do Men Want? Gender Differences and the Two Spheres of Belongingness.” *Psychological Bulletin* 122: 38–44.
- Burns, Nancy, Kay Lehman Schlozman, and Sidney Verba. 2001. *The Private Roots of Public Action: Gender, Equality and Political Participation*. Cambridge, MA: Harvard University Press.
- Campbell, David E., and Christina Wolbrecht. 2006. “See Jane Run: Women Politicians as Role Models for Adolescents.” *The Journal of Politics* 68 (2): 233–47.
- Chodorow, Nancy. 1978. *The Reproduction of Mothering*. Berkeley: The University of California Press.
- Delli Carpini, Michael X., and Scott Keeter. 1996. *What Americans Know about Politics and Why it Matters*. New Haven, CT: Yale University Press.
- Dolan, Kathleen. 2011. “Do Men and Women Know Different Things? Measuring Gender Differences in Political Knowledge.” *The Journal of Politics* 73 (1): 97–101.
- Dow, Jay K. 2009. “Gender Differences in Political Knowledge: Distinguishing Characteristics-Based and Returns-Based Differences.” *Political Behavior* 31 (1): 117–36.
- Downs, Anthony. 1957. *An Economic Theory of Democracy*. New York: Harper Collins.
- Druckman, James N. 2012. “The Politics of Motivation.” *Critical Review: A Journal of Politics and Society* 24 (2): 199–216.

- Eaves, Lindon J., and Hans J. Eysenck. 1974. "Genetics and the Development of Social Attitudes." *Nature* 249: 288–89.
- Eckel, Catherine C., and Philip J. Grossman. 1998. "Are Women Less Selfish Than Men? Evidence from a Dictator Experiment." *Economic Journal* 108 (448): 726–35.
- Fowler, James H., and Darren Schreiber. 2008. "Biology, Politics, and the Emerging Science of Human Nature." *Science* 322: 912–14.
- Fox, Richard L., and Jennifer L. Lawless. 2004. "Entering the Arena? Gender and the Decision to Run for Office." *American Journal of Political Science* 48 (2): 264–80.
- Gabriel, Shira, and Wendi L. Gardner. 1999. "Are There His and Hers Types of Interdependence? The Implications of Gender Differences in Collective versus Relational Interdependence for Affect, Behavior and Cognition." *Journal of Personality and Social Psychology* 77 (3): 642–55.
- Gaeddert, William P. 1985. "Sex and Sex Role Effects on Achievement Strivings: Dimensions of Similarity and Difference." In *Gender and Personality: Current Perspectives on Theory and Research*, eds. Abigail J. Stewart and M. Brinton Lykes. Durham, NC: Duke University Press, 198–216.
- Geary, David C. 2009. *Male, Female: The Evolution of Human Sex Differences*. Washington, DC: American Psychological Association.
- Gilligan, Carol. 1982. *In a Different Voice: Psychological Theory and Women's Development*. Cambridge, MA: Harvard University Press.
- Hannagan, Rebecca J. 2008. "Gendered Political Behavior: A Darwinian Feminist Approach." *Sex Roles: A Journal of Research* 59: 465–75.
- Hatemi, Peter K., Christopher T. Dawes, Amanda Frost-Keller, Jaime E. Settle, and Brad Verhulst. 2011a. "Integrating Social Science and Genetics: News from the Political Front." *Biodemography and Social Biology* 57 (1): 67–87.
- Hatemi, Peter K., and Rose McDermott. 2012. "The Genetics of Politics: Discovery, Challenges, and Progress." *Trends in Genetics* 28 (10): 524–33.
- Hatemi, Peter K., Rose McDermott, J. Michael Bailey, and Nicholas G. Martin. 2011b. "The Different Effects of Gender and Sex on Vote Choice." *Political Research Quarterly* 65 (1): 76–92.
- Hatemi, Peter K., Sarah E. Medland, and Lindon J. Eaves. 2009. "Do Genes Contribute to the "Gender Gap?" *Journal of Politics* 71 (1): 262–76.
- Hrdy, Sarah B. 2009. *Mothers and Others: The Evolutionary Origins of Mutual Understanding*. Cambridge, MA: Belknap Press.
- Jost, John T., Arie W. Kruglanski, Jack Glaser, and Frank J. Sulloway. 2003. "Political Conservatism as Motivated Social Cognition." *Psychological Bulletin* 129 (3): 339–75.
- Karp, Jeffrey A., and Susan A. Banducci. 2008. "When Politics is not Just a Man's Game: Women's Representation and Political Engagement." *Electoral Studies* 27 (1): 105–15.
- Krueger, Robert F., and Wendy Johnson. 2002. "The Minnesota Twin Registry: Current Status and Future Directions." *Twin Research* 5 (5): 488–92.
- Lay, J. Celeste. 2011. "The Seat of Tradition? Gender Gaps in Political Knowledge in Rural America." Paper presented at New Research on Gender in Political Psychology Conference, Rutgers University, New Brunswick, NJ.
- Lazarsfeld, Paul Felix, Bernard Berelson, and Hazel Gaudet. 1944. *The People's Choice: How the Voter Makes Up His Mind in a Presidential Election*. New York: Columbia University Press.
- Low, Bobbi. 2000. *Why Sex Matters: A Darwinian Look at Human Behavior*. Princeton, NJ: Princeton University Press.
- Littvay, Levente. 2010. *The Genetic Heritability of Survey Response Styles*. Master's thesis, University of Nebraska–Lincoln.

- . 2012. “Do Heritability Estimates of Political Phenotypes Suffer From an Equal Environment Assumption Violation? Evidence from an Empirical Study.” *Twin Research and Human Genetics* 15 (1): 6–14.
- Littvay, Levente, Sebastian Adrian Popa, and Zoltán Fazekas. 2013. “Validity of Survey Response Propensity Indicators: A Behavior Genetics Approach.” *Social Science Quarterly* 94 (2): 569–89.
- Littvay, Levente, Paul Weith, and Christopher T. Dawes. 2011. “Sense of Control and Voting: A Genetically Driven Relationship.” *Social Science Quarterly* 92 (5): 1236–52.
- Lizotte, Mary-Kate, and Andrew H. Sidman. 2009. “Explaining the Gender Gap in Political Knowledge.” *Politics & Gender* 5 (2): 127–51.
- Lupia, Arthur, Matthew D. McCubbins, and Samuel L. Popkin. 2000. *Elements of Reason: Cognition, Choice, and the Bounds of Rationality*. Cambridge, UK: Cambridge University Press.
- Luskin, Robert. 1990. “Explaining Political Sophistication.” *Political Behavior* 12 (4): 331–61.
- Luskin, Robert C., and John G. Bullock. 2011. “‘Don’t Know’ Means ‘Don’t Know’: DK Responses and the Public’s Level of Political Knowledge.” *The Journal of Politics* 73 (2): 547–57.
- Lykken, David T., Thomas J. Bouchard Jr., Matthew McGue, and Auke Tellegen. 1990. “The Minnesota Twin Family Registry: Some Initial Findings.” *Acta Geneticae Medicae et Gemellogicae* 39: 35–70.
- Martin, Nicholas G., Lindon J. Eaves, Andrew C. Heath, Rosemary Jardine, Lynn M. Feingold, and Hans J. Eysenck. 1986. “Transmission of Social Attitudes.” *Proceedings of the National Academy of Sciences* 83 (12): 4363–68.
- Mayhead, Molly A., and Brenda Devore Marshall. 2005. *Women’s Political Discourse: A 21st Century Perspective*. New York: Rowman & Littlefield.
- McDermott, Rose, and Peter K. Hatemi. 2011. “Distinguishing Sex and Gender.” *PS: Political Science and Politics* 44 (1): 89–92.
- McGlone, Matthew S., Joshua Aronson, and Diane Kobrynowicz. 2006. “Stereotype Threat and the Gender Gap in Political Knowledge.” *Psychology of Women Quarterly* 30 (4): 392–98.
- Medland, Sarah E., and Peter K. Hatemi. 2009. “Political Science, Behavior Genetics and Twin Studies: A Methodological Primer.” *Political Analysis* 17: 191–214.
- Mondak, Jeffery J., and Mary R. Anderson. 2004. “The Knowledge Gap: A Reexamination of Gender-based Differences in Political Knowledge.” *The Journal of Politics* 66 (2): 492–512.
- Moore, David W. 1987. “Political Campaigns and the Knowledge-Gap Hypothesis.” *Public Opinion Quarterly* 51 (2): 186–200.
- Muthen, Linda K., and Bengt O. Muthen. 2008. *Mplus Version 5, Statistical Analysis with Latent Variables. User’s Guide*. Los Angeles, CA: Muthen and Muthen.
- Neale, Michael C., and Hermine H. M. Maes. 2004. *Methodology for Genetic Studies of Twins and Families*. Dordrecht, The Netherlands: Kluwer Academic Publishers B. V.
- Niederle, Muriel, and Lise Vesterlund. 2007. “Do Women Shy Away from Competition? Do Men Compete Too Much?” *Quarterly Journal of Economics* 122 (3): 1067–1101.
- Page, Benjamin I., and Robert Y. Shapiro. 1992. *The Rational Public: Fifty Years of Trends in Americans’ Policy Preferences*. Chicago: The University of Chicago Press.
- Pemberton, Michael B., Chester A. Insko, and John Schopler. 1996. “Memory for and Experience of Differential Competitive Behavior of Individuals and Groups.” *Journal of Personality and Social Psychology* 71 (5): 953–66.
- Popa, Sebastian Adrian. 2013. “Political Sophistication in Central and Eastern Europe: How Can Parties Help?” *Party Politics*. <http://ppq.sagepub.com/content/early/2013/06/02/1354068813487104> (accessed December 3, 2013).

- Popescu, Marina, and Gábor Tóka. 2009. "The Impact of Media Systems on the Making of Informed Election Outcomes." Paper presented at the 58th Annual Conference of the International Communication Association, Montreal, Quebec.
- Powell, G. Bingham, Jr. 2000. *Elections as Instruments of Democracy: Majoritarian and Proportional Visions*. New Haven, CT: Yale University Press.
- Sapiro, Virginia. 2003. "Theorizing Gender in Political Psychology Research." In *Oxford Handbook of Political Psychology*, eds. David O. Sears, Leonie Huddy, and Robert Jervis. Oxford, UK: Oxford University Press, 601–36.
- Shultziner, Doron. 2013. "Genes and Politics: A New Explanation and Evaluation of Twin Study Results and Association Studies in Political Science." *Political Analysis* 21 (3): 350–67.
- Smith, Kevin B., Douglas R. Oxley, Matthew V. Hibbing, John R. Alford, and John R. Hibbing. 2011. "Linking Genetics and Political Attitudes: Reconceptualizing Political Ideology." *Political Psychology* 32 (3): 369–97.
- Somin, Ilya. 2004. "When Ignorance isn't Bliss: How Political Ignorance Threatens Democracy." *Policy Analysis* 525 (22): 1–28.
- Stolle, Dietlind, and Elisabeth Gidengil. 2010. "What do Women Really Know? A Gendered Analysis of Varieties of Political Knowledge." *Perspectives on Politics* 8 (1): 93–109.
- Stroud, Laura R., Peter Salovey, and Elissa S. Epel. 2002. "Sex Differences in Stress Responses: Social Rejection versus Achievement Stress." *Biological Psychiatry* 52 (4): 318–27.
- Sturgis, Patrick. 2003. "Knowledge and Collective Preferences: A Comparison of Two Approaches to Estimating the Opinions of a Better Informed Public." *Sociological Methods & Research* 31 (4): 453–85.
- Sturgis, Patrick, Nick Allum, and Patten Smith. 2008. "An Experiment on the Measurement of Political Knowledge in Surveys." *Public Opinion Quarterly* 72 (1): 90–102.
- Thomas, Melanee. 2012. "The Complexity Conundrum: Why Hasn't the Gender Gap in Subjective Political Competence Closed?" *Canadian Journal of Political Science* 45 (2): 337–58.
- Thomas, Melanee, Allison Harell, and Tania Gosselin. 2013. "Cuing the Gap: Gender and Psychological Orientations to Politics." Paper presented at Gender and Political Psychology Research Workshop, Naperville, IL.
- Thompson, Lori Foster, Zhen Zhang, and Richard D. Arvey. 2011. "Genetic Underpinnings of Survey Response." *Journal of Organizational Behavior* 32 (3): 395–412.
- Van Vugt, Mark, David De Cremer, and Dirk P. Janssen. 2007. "Gender Differences in Cooperation and Competition: The Male-Warrior Hypothesis." *Psychological Science* 18 (1): 19–23.
- Verba, Sidney, Nancy Burns, and Kay Lehman Schlozman. 1997. "Knowing and Caring about Politics: Gender and Political Engagement." *The Journal of Politics* 59 (4): 1051–72.
- Verhulst, Brad, and Peter K. Hatemi. 2013. "Gene-Environment Interplay in Twin Models." *Political Analysis* 21 (3): 368–89.
- Vigil, Jacob Miguel. 2009. "A Socio-Relational Framework of Sex Differences in the Expression of Emotion." *Behavioral and Brain Sciences* 32 (5): 375–428.
- Zaller, John, and Stanley Feldman. 1992. "A Simple Theory of the Survey Response: Answering Questions versus Revealing Preferences." *American Journal of Political Science* 36 (3): 579–616.
- Zukin, Cliff, and Robin Snyder. 1984. "Passive Learning: When the Media Environment is the Message." *Public Opinion Quarterly* 48 (3): 629–38.

APPENDIX

Multiple-choice Knowledge Questions with Offered Responses

1. Who has the final responsibility to decide if a law is constitutional or not? (the president, congress, the Supreme Court, not sure)
2. Whose responsibility is it to nominate judges to the federal courts? (the president, congress, the Supreme Court, not sure)
3. Which of the political parties is more conservative than the other at the national level? (Democrats, Republicans, not sure)
4. How much of a majority is required for the U.S. Senate and House to override a presidential veto? (a bare majority of 50% plus one, two-thirds majority [67% or more], three-fourths majority [75% or more], not sure)
5. What is the main duty of the U.S. Congress? (to write laws, to administer the president's policies, to supervise states' governments, not sure)

	<i>Female</i>				<i>Male</i>			
	<i>% Correct</i>	<i>% Incorrect</i>	<i>% DK</i>	<i>N</i>	<i>% Correct</i>	<i>% Incorrect</i>	<i>% DK</i>	<i>N</i>
Who has the final responsibility to decide if a law is constitutional or not?	62.51	29.52	7.40	827	82.16	13.24	3.01	494
Whose responsibility is it to nominate judges to the federal courts?	63.19	18.13	13.05	826	78.95	12.97	8.07	494
Which of the political parties is more conservative than the other at the national level, Democrats or Republicans?	71.19	14.54	14.12	828	80.15	10.49	9.31	494
How much of a majority is required for the U.S. Senate and House to override a presidential veto?	69.19	12.67	18.09	828	83.35	6.47	10.18	493
What is the main duty of the U.S. Congress?	59.06	23.32	17.63	828	78.10	11.74	8.33	493