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The Genetics of Voting: An Australian Twin Study

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Abstract Previously we and others have shown evidence for genetic influences on political attitudes and sociodemographic indicators (Martin 1987; Posner et al. 1996; Truett et al. 1992; Eaves et al. 1999). However, the nature of the relationship between political attitudes, social indictors and voting behavior has not been investigated. While heritability estimates for social and political attitudes have been reported in previous research, the heritability for vote choice has not. Furthermore, if vote choice is heritable, it is unclear whether the heritable component can be accounted for through the genetic influence on related social and political traits, or if there exists a unique genetic component specific to voting behavior. In mailed surveys of adult Australian twins, we asked respondents to indicate their usual voting preference as well as attitudes on contemporary individual political items. When vote choice was dichotomized as Labor versus Conservative, twin correlations were $r_{mz} = 0.81$ (1661 pairs), and $r_{dz} = 0.69$ (1727 pairs) consistent with modest genetic influence ($a^2 = 0.24$). However, multivariate genetic analysis showed no unique genetic contribution to voting preference; rather, the genetic influence in vote choice could be explained by shared genetic influences in perceived social class, church attendance and certain key political attitude items.

Keywords Voting · Political attitudes · Sociodemographic indicators · Liberal · Conservatism

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Introduction

Numerous studies have shown evidence for genetic influences on social and political attitudes (Martin et al. 1986; Truett et al. 1992; Eaves et al. 1998, 1999). Large scale studies of Australian twins that utilized responses to the Wilson–Patterson Conservatism Scale found a moderate contribution of genetic factors in the variation of political opinions and that the transmission of political attitudes could not be explained by social conditioning or purely environmental channels (Martin et al. 1986). Opinions on abortion, immigration, death penalty, euthanasia, conservatism, authoritarianism as well as behaviors such as religiosity and educational attainment have been found to be significantly heritable; while individual differences in religious affiliation and political partisanship are primarily environmental in origin

(Eaves et al. 1989; Olson et al. 2001; Bouchard et al. 2003).

More recently, the genetics of political attitudes and voting has received renewed interest. Alford et al.'s (2005) publication in the American Political Science Review (APSR) ''Are Political Orientations Genetically Transmitted?'' summarized and recast previous findings in the behavior genetics discipline by Eaves and Martin into a social science frame. The attention in the social sciences and mass media was significant, and the article quickly became the most viewed and downloaded in APSR history (Alford and Hibbing 2006). Although the study was heralded as possibly among the ''the most important articles the APSR has ever published'' (Sigelman 2006), the study principally focused on political attitudes and did not address the pinnacle of political behaviors, vote choice.

Traditional vote choice theories

Traditional vote choice theories make important assumptions regarding voting behavior that differ from typical assumptions made by behavior geneticists, thus requiring some explanation. Most importantly, traditional voting theories focus principally on environmental influences on vote choice, providing no explicit role for genetic factors. The dogma of the French sociologist Emile Durkheim (1938 [1985]:110) continues to persist today among social and political scientists, ''The determining cause of a social fact should be sought among the social facts preceding it and not among the states of individual consciousness.'' Durkheim's reasoning has led to today's incorporation of the social science model, and the overwhelming majority of political science research adheres to this model, which attributes 100% of behavior differences to socialization factors or reactions to external stimuli (Corning 1971; Tooby and Cosmides 1992). In the political science literature there are two overarching theories of vote choice based upon the social science model; one centered on psychological attachments to parties and socio-political groups (Campbell et al. 1960) and the second centered on rational choice or economic voting (Downs 1957; Popkin 1991).

Examining voters' decisions from a socio-psychological perspective, the ''Michigan School'' found that voters relied more on stable political party identification and partisan attitudes, minimizing the vote choice effects of specific elections (Campbell et al. 1960). A significant part of the Michigan approach is the idea that vote choice is largely attributed to familial socialization factors (Campbell et al. 1960; Page and Jones 1979; Carmines and Stimson 1980). This approach does not take into account the scholarly work that finds variation in social class and other socio-economic traits can be influenced by genetic factors (Eaves et al. 1989). From a socio-psychological view, vote choice is a function of common environment, and minimal unique environment, but allows no room for genetic influences.

The alternative and increasingly dominant vote choice model in political science rests on the assumption of a ''rational'' voter (Downs 1957; Popkin 1991). Accordingly, emergent social phenomena such as voting behaviors are ultimately the result of rational choices made by self-interested utility-maximizing individuals (Lichbach 2003). Preferences (attitudes) are given; they are a ''black box'' and the sources of political attitudes are irrelevant. Political action, such as voting, is nothing more than revealed preferences and voting decisions are based upon reactions to external stimuli, or unique environment (Tooby and Cosmides 1992; Alford et al. 2005). The rational voter model was conceptualized as dealing solely with what would be considered common and unique environmental influences. However, following the logic of rational choice should allow for the possibility of genetic sources through its ''black box'' approach to the source of preferences. This idea has not been canvassed by proponents of rational voter theory, and is not explicitly stated, nor ever utilized in the literature prior to this study as far as we know. Thus, although rational vote choice is currently viewed as a function of unique environment plus the explicit potential of common environment, we propose it could be also interpreted as the implicit possibility of genetic effects. However, there is one important caveat; rational choice adheres to the concept that all expressed action is derived from cognitive thought, implying that a person must know their attitudes in order to engage in utility maximization.

Numerous studies offer significant challenges to both models' validity. Indeed, empirical evidence from political psychology suggests that voters are highly and often unwittingly receptive to framing effects, in which either the media or the elite portrays a political issue that in turn determines how the public looks at that specific issue (Iyengar and Kinder 1987). By evoking particular behavioral motivations relating to anxiety and fear, elites are able to alter individual decision-making processes, which, in turn, influence political participation. Given that susceptibility to framing effects extends to all segments of the

population, regardless of socio-demographics or existing political knowledge (Nelson et al. 1997; Druckman 2004), emotions serve as universally powerful behavioral representations of human motivations, significantly affecting political decision-making behavior, which preclude rationality or familial socialization.

Moreover, studies of mass public opinion suggest that political behavior is relatively inconsistent and voters use ''considerations'' that vary according to the context of the specific election (Zaller 1992). Thus, counter to the socio-psychological approach, unique environment is of the highest importance, as context matters (Druckman 2001; Nelson 2004). Contrary to the Michigan approach, rational choice promotes the importance of unique environment, and has shown to be a useful model to explain the cognitive portions of human evaluation, but it is also heavily criticized. Studies have shown that perceived threats of policy change are considerably more powerful vote choice motivators than perceived opportunities for policy change; thus suggesting affective motivations, not rational cognitions drive political behavior (Miller and Krosnick 2004). Important in this dialogue is what has been labeled ''hard'' or ''easy'' issues (Carmines and Stimson 1980). ''Hard'' issues, such as water policy, require cognitive evaluation, whereas certain ''easy'' issues, such as the death penalty and gay marriage, trigger a ''gut'' response which illicit instant and strong opinions with negligible evaluation. Though not explicitly stated in the social science literature, these ''gut'' reactions are what have been stated in evolutionary based research to be an expression of adaptive traits, thus heritable in nature (Darwin 1859; Bruell 1970; Wilson 1998; Alexander 2004).

In short, both major vote choice paradigms assume the environment as the only source of preferences, but differ greatly on the emphasis of either common or unique environment. Furthermore, both major theories as well as all secondary theories in the political science literature ignore the potential for biological explanations of political preferences (for more on the primacy of the environment see Cook 1985; Merelman 1986; Sears 1989; Landemore 2004; Alford et al. 2005).

Thus, the aim of the current analyses is to incorporate methods and ideas from the field of behavior genetics into political science to address two essential questions: (1) To what extent do either genetic or environmental factors, or both, influence the most fundamental of mass political behaviors such as vote choice, and (2) given the relevant scientific findings, are the current major political science theories utilized to examine voting valid? Can we use biological models to test the validity of both the Michigan Model and Rational Choice for vote choice and other political behaviors?

Australian political parties in 1988–1990

In this paper we analyze self reports of vote choice gathered in surveys of twins contacted in 1988–1990. As this is the first genetics study examining voting behavior, and not all readers will be familiar with Australian politics in 1990, some explanation of Australia's political system is warranted. The Australian political system is typically characterized as a two and a half party system. In general, the Australian Labor Party (Labor) competes nationally with the Liberal and National parties in coalition (Conservatives) (Moon and Sharman 2003). Both coalition parties are right of center in orientation but the Liberals have a more urban base, while the National Party has a mainly rural base. At the time of the survey Labor was in power at the federal level and had held control since 1983. While Labor was able to maintain control of government for 6 more years (1996), the 1990 election witnessed a swing to the Conservatives as Australia was faced with high interest rates and an economic downturn. The results of the elections saw the Conservatives win over 43% of the vote, gaining 8 seats in the House of Representatives, compared to Labor's 39% and loss of 5 seats (Ward 1990). The most significant minor party at the time, the Australian Democratic Party (Democrats), had never competed against the major parties for control of government, but held the balance of power in the Senate (Simms 1996). During the 1988–1990 period the Democrats reached their electoral peak in terms of overall voter percentage in federal elections (over 11%). Since 1990 support for the Democrats has eroded to less than 3% and their voters have defected to the Conservatives and the Greens in equal numbers, but almost none to Labor (Grattan 2000).

Regarding the Labor and Conservative parties, by 1990 competing party leaders shared similar social-demographic backgrounds and the Labor Party had become more middle-class, resulting in less social differentiation from the Conservatives (Jaensch 1989). Even so, there remains a strong identification difference between those who claim partisanship to either party. This difference is seen clearly in key issues positions such as social welfare, organized

labor and health coverage (Jaensch 1989; Grattan 2000). Due to these issue differences, the parties remain diametrically opposed in both elite discourse and in the views held by the mass public (Warhurst 1997).

Methods

Samples

Data were collected in the course of mailed surveys of two large cohorts of adult Australian twins born 1902–1972 conducted in 1988–90. The first cohort was a follow-up survey of twins enrolled on the volunteer Australian Twin Registry born 1893–1964 originally surveyed from 1980–82 (Martin et al. 1986). The sample consisted of 7,616 twin men and women (3,808 twin pairs) aged 18–88 years (Martin 1987; Eaves et al. 1989; Truett et al. 1992). In 1988–90 we surveyed this cohort with the Health and Lifestyle Questionnaire (HLQ), which contained items on voting preference, social attitudes and a variety of socio-demographic variables including basic demographics. After mail and telephone follow-ups, questionnaires were returned by 6,327 individuals (83.1%) including 2,995 complete pairs (78.7%). Excluding people who had died or were too sick to participate (217 individuals) or with whom contact could no longer be made (270 individuals), return rates for those who received and were able to return the 1988 questionnaire were 88.8% individually and 85.6% pairwise (Baker et al. 1996).

The second cohort study (1988–90) attempted to survey by mailed questionnaire all twins enrolled on the Australian Twin Registry who had turned 18 since the first survey (i.e. birth years 1964–1972). The HLQ, which was similar to that sent to the older cohort, was mailed to 4,269 pairs. Most of these twins had been recruited while attending primary school some 10 years earlier, so despite extensive follow-up we were unable to re-establish contact with (exactly) 1000 pairs. Those who failed to return a questionnaire were contacted by telephone up to five times at which point they were asked to complete an abbreviated telephone interview to obtain missing basic demographic information. Both members of 2,294 pairs (70% of contactable pairs) completed a questionnaire or abbreviated phone interview, including 474 single twins, making an individual cooperation rate of 84% of those with whom contact was established. Combining both cohorts 11,376 questionnaire responses (5,289 complete pairs) in which the voting preference item was asked were received, and of these 9,053 individuals responded to the vote choice question. The same items were used in both HLQ surveys. However, a limited number of respondents in the AL2 cohort received abbreviated telephone questionnaires where certain socio-political questions were not included.

Comparisons with the Australian Bureau of Statistics provide evidence that these groups are representative of the population in general with regard to education, socioeconomic status and social behaviors, as reported in earlier studies (Jardine and Martin 1984; Kendler et al. 1995; Baker et al. 1996; Heath et al. 1997; Whitfield et al. 2005). Median age at participation of both cohorts combined was 34 years.

Zygosity

Zygosity was determined by two self report items. This method has been shown to provide probably better than 95% agreement with blood typing (Martin and Martin 1975). In addition, blood group and microsatellite marker information has been used to supplement respondent self reports in previous studies using these specific samples (Whitfield et al. 2004).

Measures

The primary phenotype of vote choice is assessed by the questionnaire item: ''VOTING PREFERENCE.'' Under this heading twins were asked ''Generally speaking, in *federal* politics do the following people usually think of themselves as: (1) Liberal Party, (2) Labor Party, (3) National Party (4) Australian Democrat (5) Other (6) None of Your Business?''. Twins were asked to report for ''You, Your Twin, Your mother, Your father, Your spouse''. Only self-reports are analyzed here. Based upon the nature of Australian politics at the time of the survey as discussed above, for all analyses the Liberal and National party voters were combined into a single ''Conservative'' category and all analyses were performed utilizing a dichotomous variable of either voting for Conservatives or Labor. Respondents who responded in the ''Other'' and ''None of Your Business'' categories (10%) were set to missing.

The continuous trait underlying the distinction between conservative and labor is voters' overall ideological issue position. In a system where political competition between two parties is the pursuit of

electoral victory, voters choose between the parties on the basis of their issue platforms; these platforms represent positions on an ideological scale. Each individual votes for the party closest to their preferences and as such rational parties move toward the center of issue platforms in order to be attractive to the largest voter distribution (Downs 1957). In short, parties converge at the preference location of a normally distributed voter populace. This model holds true in western societies as the ideological dispositions of voters are normally distributed and serious party contenders (e.g. Coalition and Labor) are centrist (Downs 1957; Popkin 1991).

In addition to voting, a number of other sociodemographic variables and political attitudes potentially related to vote choice were analyzed. Traditional sociodemographic voting correlates including age, education, social class, religion and church attendance (Campbell et al. 1960; Popkin 1991) were assessed in both cohorts (Table 1). Date of birth, originally a continuous variable, was used to divide the respondents into seven age groups (Sapiro et al. 2002) routinely used for vote choice studies in the political science literature (18–24, 25–34, 35–44, 45–54, 55–64, 65–74, 75+).

Political attitudes were assessed utilizing a modified version of the 50-item attitude checklist used to construct the Wilson and Patterson (1968) Conservatism Scale, which includes contemporary social issues of the time. Respondents indicated if they agreed (1), disagreed (3), or were uncertain (2) about their attitudes towards these different issues (Posner et al. 1996).

Table 1 Distribution of age, education, social class, religious denomination and church attendance by voting preference (%)

	Conservative	Labor	Democrat
Age			
Mean	37.1	34.1	30.2
SD	15.2	13.4	10.1
Education			
<7 years	1.4	1.3	0
8–10 years	24.0	24.4	14.6
11–12 years	27.5	24.8	22.2
Apprenticeship/diploma	15.9	13.2	14.2
Tech/Training College	13.9	13.1	16.8
Undergraduate	12.6	16.1	26.9
Postgraduate	4.7	7.1	5.3
Social class			
Working	19.9	34.1	24.9
Middle or Higher	80.1	65.9	75.1
Religious denomination			
None	10.8	24.8	30
Evangelical/Fundamentalist	9.2	5.0	6.7
Other Protestant	56.0	39.4	37.3
Catholic	21.3	26.5	19
Jewish	0.6	0.7	1.0
Orthodox	0.5	1.4	1.2
Other	1.6	2.2	4.9
Church attendance			
2+ Weekly	7.4	4.1	6.7
Weekly	16.8	11.4	9.8
Monthly	11.0	7.40	8.3
Yearly	20.2	17.2	19.4
Rarely	44.6	60.0	55.8
N^a	4222	3191	519

Note: (a) Due to missingness, cases for Conservatives range from 4080–4222, for Labor 3079–3191 and Democrats 506–519

Preliminary analyses

Phenotypic frequencies and descriptive statistics using raw data were calculated using SPSS 13 (SPSS Inc. 2003). In order to distinguish which political traits best correlate with voting behavior, we performed discriminant function analyses using all 50 items from the revised Wilson–Patterson Conservatism scale. The smaller the Wilks's lambda, the more important the independent variable is to the discriminant function. The standardized discriminant function coefficients serve the same purpose as beta weights in multiple regression and indicate the relative importance of the independent variable in predicting the dependent (vote choice). Using these two measures we selected the best predictors for voting behavior. Two separate discriminant analyses were used to identify which items best distinguished Conservative from Labor voters, and Democrat from both Labor and Conservative voters.

To determine the degree of the relationship between sociodemographic traits, political attitudes and vote choice, and using items selected based upon the findings in the discriminant analyses, separate polychoric correlations by twin pair zygosity and opposite sex twin pairs were calculated for each phenotypic trait using Mx 1.60 (Neale et al. 2003). Polychoric correlations between voting behavior and the selected sociodemographic and political items were calculated using Mx for males and females separately (95% CI). The observed frequencies for each of the ordinal phenotypic traits were fitted to a threshold model that assumes that each variable has an underlying normal distribution of liability (Neale and Cardon 1992). The thresholds are expressed as z values which discriminate between categories that correspond to the frequency of the sociodemographic and political vote choice indicators. We tested if the thresholds were similar across sex and across twin zygosity groups. Thresholds were corrected for age effects.

Univariate analyses

While significant twin correlations establish a familial relationship, they cannot distinguish between genetic and environmental effects, or separate between common or unique environmental effects. However, by using structural equation modeling, the variance of the phenotypic traits can be decomposed into an additive genetic component (A), a common environmental (C) or nonadditive genetic component (D), and a unique environmental component (E). The ACDE decomposition is subject to the limitation that, with only MZ and DZ twin pairs reared together, nonadditive genetic and common environmental influences are confounded; thus separate ACE and ADE models are typically tested and compared. This approach to the estimation of heritable and environmental variance is extensively used and earlier sets of these data have been analyzed in this manner in previous research (Martin et al. 1986; Neale and Cardon 1992; Truett et al. 1992). However, previous studies examining social and political behaviors have not found significant nonadditive genetic components, therefore only ACE models were examined in this study (Martin 1987; Truett et al. 1992).

Univariate genetic models using raw data were fit to vote choice, sociodemographic indicators and the political items selected based upon the findings in the discriminant analyses. Mx 1.60 (Neale et al. 2003) was used for genetic model fitting. Correlations between the latent additive genetic factors were 1 for monozygotic twins (MZ) and 0.5 for dizygotic twins (DZ), including opposite sex pairs (OS). Correlations between the latent common environment factors were 1 in both MZ and DZ twin pairs. As the data of opposite sex DZ twin pairs were available, non-scalar sex-limitation models were used to analyze the data. Sex limitation models assume the same sources of variation for males and females, but allow for differences in the extent to which the same genetic and environmental factors influence a trait. Ninety-five percent confidence intervals for each element of A, C and E were estimated in Mx. Sex and age were also included in the threshold model to control for any relationship between these fixed effects and vote choice.

Multivariate analyses

Multivariate analysis permits both the determination of sources of covariation and the structure in which the related phenotypic traits influence vote choice. Several Cholesky decompositions were used to assess the extent to which the heritable and environmental components of vote choice were explained by (1) the genetic and environmental influences shared with the selected sociodemographic indicators and political attitudes and (2) the genetic and environmental influences not shared with sociodemographic indicators and political attitudes and therefore specific to vote choice.

In the Cholesky decomposition, the number of additive genetic, common environment and unique environmental elements are equal to the number of phenotypic traits (Neale and Cardon 1992). Variance is partitioned to estimate the proportion of the genetic, common environment and unique environmental variance of all variables in subsequent order beginning with the variance of the first variable. The second variable in the model is assumed to be caused by a second latent factor that also explains part of the variance of the five remaining variables, and so on (Loehlin 1996). As the object of this analysis is to explain the heritability and environmental variance of voting behavior, the last variable in the Cholesky decomposition is vote choice, which is assumed to be caused by a seventh latent factor explaining the variance of voting behavior that has not yet been explained by the variance of all of the previous latent factors in the analyses (Truett et al. 1992). As implied, the Cholesky decomposition is only valuable in multivariate analysis of simultaneously measured correlated variables if the variables are placed in a ''rationally defined order of priority'' which fits the logic of the construct under analysis (Loehlin 1998). The seven variables selected based upon the discriminant analyses are as follows: social class, church attendance, and attitudes on socialism, medicare, trade unions, and private schools. The selection of the variables and order were determined after completion of the discriminant analyses and discussed under the results section.

Similar to the univariate analysis, Mx 1.60 (Neale et al. 2003) was used for the Cholesky analyses. In order to reduce complexity, and due to sex-limitation for some of the items in the analyses, multivariate analyses were restricted to same sex twin pairs for whom complete data were available. Analyses were performed for each sex separately and all multivariate structural equation modeling was conducted on polychoric correlation matrices using weighted least squares estimation based upon the asymptotic covariance matrices supplied by PRELIS 2 (Jöreskog and Sörbom 1999). The asymptotic covariate (weight) matrices were also included in the analyses.

Sub-models and model fitting

Several models were fit to the data to test the possibility of different genetic and environmental components of vote choice. For both the univariate and multivariate analyses, in order to determine the importance of the A, C and E components, the full ACE models were tested against progressively reduced models. The significance of the variance components were assessed by testing whether dropping A or C reduced model fit.

In the univariate analyses, due to the availability of opposite sex pairs, nested models that equated the separate path coefficients for males and females were examined and compared to the full sex limitation ACE model in order to test whether sex specific differences in the magnitude of the variance components provide a better model fit than without sex differences.

For the multivariate analyses several reduced models were tested against the full Cholesky to identify the best fitting and most parsimonious model for males and females separately. All factor loadings were first estimated in full Cholesky decomposition; tests of their significance were conducted by setting them to zero and re-estimating the other parameters (reduced models). The nested models were simplified by determining whether the removal of successive individual parameters resulted in a significant worsening fit of the model to the data. These reduced models include removing the additive genetic variance components from specific trait paths related to vote choice.

Model fit is assessed by using the –2 log likelihood (–2LL), chi-square statistic, associated *P*-value, and Akaike's Information Criterion. The fit of nested models is primarily evaluated using the likelihood ratio test, which compares the –2LL of the saturated model to the reduced model. As the resulting test is symtotically distributed as a chi-square, the change in model fit can be assessed by comparing the difference in –2LL, with degrees of freedom equal to the difference in parameters estimated in the different models. A non-significant difference in chi-square indicates the more parsimonious model is a better fitting model. The fit of non-nested models (which cannot be assessed using a likelihood ratio test) is evaluated using Akaike Information Criterion (AIC), a measure of goodness-of-fit and model parsimony (AIC = –2LL minus twice the degrees of freedom). In the case of comparisons between non-nested models, the most parsimonious of these models is the one with the lowest AIC (Akaike 1987; Neale and Cardon 1992).

Results

Voting preference was answered by 5,594/6,325 (88%) twin individuals from the older cohort and 3,459/5,051 (69%) from the younger cohort for a total response of 9,053 (80%). Because of missing values for covariates, the use of only Labor and Conservative voters, and the use of only same sex twin pairs in the multivariate analyses, the numbers for some analyses will be smaller. Conservatives accounted for 46% of the sample, Labor 35% and Democrats 6%. The official voter turnout in the 1990 election was 43.5% Conservative, 39.4% Labor and 11% Democrat. In comparison to the general public at the time of the survey our sample slightly favored the Conservatives versus Labor (about 3–4%), and under represented Democrats (about 5%). The total sample was 61.4% female and 38.6% male, thus our sample favored females. The age range was 18–88 (mean = 34, standard deviation = 13.8) and the mean age was 38-years-old for Conservatives, 35 for Labor and 31 for Democrats. Voters in the younger age groups from 18 to 34 supported Labor over Conservatives by over 10 percentage points, and voters over 55 gave greater support (25–40%) to Conservatives over Labor. These results were similar to the voting habits of the general public (Curtin 1998; Newman 1996).

Educational levels were fairly similar for Conservative and Labor voters, while Democrats were noticeably better educated having almost twice as many people with degrees (32%) than Labor or Conservatives (16% and 17% respectively) (Table 1). More Labor voters identified themselves as working class (34%) than Conservatives (20%) or Democrats (25%). Conservatives were significantly more religious than Labor or Democrats, with 89% identifying with a religion, and 35% attended religious services at least once a month, while Labor and Democrat voters were much less likely to identify with a religion (75% and 70% respectively) or regularly attended church (23% and 24% respectively).

Discriminant analysis

Table 2 presents only the political items that most discriminate between voting behaviors. Comparing Conservative and Labor voters, attitudes on socialism, medicare, trade unions and private schools had both the lowest Wilks' Lamdas and the highest standardized function coefficients, indicating they are the strongest discriminators. Conservative voters tended to be in favor of royalty, strict rules and private schools, and against socialism, trades unions, gay rights and teenage

Table 2 Attitude items (% yes) that best discriminate between conservative, labor and democrat voters

	Conservative	Labor	Democrat
Conservative versus other			
Socialism	11	37	27
Medicare	54	85	77
Trade Unions	32	64	60
Royalty	67	43	41
Gay rights	23	42	53
Privatization	54	35	42
Strict rules	70	53	43
Teenage dole	14	29	28
Private schools	83	65	70
Democrat versus other			
Conservationists	65	75	88
Defense spending	69	52	39
Multiculturalism	62	71	81
Disarmament	57	72	83
Total *N*	4189	3174	516

Table 3 Twin correlations for voting, sociodemographic traits and key political attitudes

	MZF	DZF	MZM	DZM	DZOS
Conservative versus Labor	0.79	0.68	0.84	0.83	0.64
Social class	0.62	0.45	0.67	0.51	0.48
Church monthly	0.63	0.44	0.69	0.54	0.44
Socialism	0.38	0.23	0.42	0.26	0.13
Medicare	0.46	0.29	0.48	0.30	0.14
Trade unions	0.43	0.23	0.45	0.38	0.28
Private schools	0.41	0.34	0.56	0.47	0.33
N pairs[a]	1239	732	579	328	782

Note: (a) Correlations were estimated using full information maximum likelihood observations on incomplete pairs. Due to missingness, the number of complete pairs range from: MZF (1133–1239), DZF (689–732), MZM (528–732), DZM (308–328)

dole (unemployment benefit). Labor voters are much more favorable to medicare (free universal access to health care) and less favorable to privatization. A second discriminant analysis found that defense spending, gay rights, conservation, and disarmament are the best discriminators distinguishing Democrats from all others (Table 2). Based upon these results, we identified the following six variables as most strongly associated with voting preference (Conservative versus Labor): two sociodemographic indicators of social class and church attendance, as well as four political attitudes on socialism, medicare, trade unions, and private schools.

The findings in the preliminary and discriminant analyses add further support to the use of the Australian Twin Registry as representative of the general voting public in 1990. The vote choice self reports in the Australian Twin Registry 1988–1990 survey would have accurately predicted the Conservative gains in the federal elections of 1990 (Ward 1990). Furthermore, the main political issue differences between the parties found in the extant literature (Jaensch 1989; Warhurst 1997; Grattan 2000; Moon and Sharman 2003) are also those identified by our statistical analyses performed on our sample.

One could make a significant argument to include Democrats with the Conservatives as roughly half of the Democrats have joined the Conservatives since 1990 (the other half joined the Greens). However, while the Democrats may appear more similar to Conservatives than Labor on economic issues, the Democrats are also more similar to Labor than Conservatives on social and environmental issues. Furthermore, as emphasized in their ''Keep The Bastards Honest'' party slogan, the Democratic Party positions itself as a voice for voters to check the powers of the current government, regardless of who is in power, whether Labor or Conservative (Simms 1996). Based upon their differentiation from both major parties and due to Democrats being a minor element in Australian electoral politics (making up less than 5% of the sample), only data for Labor versus Conservative voters will be reported in the subsequent analyses.

The phenotypic polychoric correlations by twin pair zygosity are shown in Table 3. Table 4 presents the polychoric correlations between items for females and males. Correlations were higher for MZ pairs than DZ pairs and in most traits higher for males than females. There are also some substantial differences in the correlations of opposite sex pairs compared to those for same sex DZ pairs. These results led us to examine several models to explain the sources of variation, including univariate sex limitation models, and nested models that equate the path components for men and women.

The heritability of vote choice

Univariate models containing additive genetic, common environmental and unique environmental variance components were fitted to determine which model best explains voting behavior (Table 5). After testing for the need to correct for sex, we found that there were no significant sex differences in the thresholds. The sex-limitation model containing additive genetic, common environment and unique environment components (ACE) for females, but only common environment and unique environment components (CE) for males was not significantly different ($P = 0.99$) from the full sex limitation model and provided a more parsimonious fit (0 change in chi-square, for 1 degree of freedom). According to

Table 4 Polychoric correlations[a] between vote choice, political attitudes, and sociodemographic covariates; males upper triangle, females lower triangle

	Males (N = 3140)							
	1	2	3	4	5	6	7	8
1. Cons versus labor		–0.14	–0.16	0.49	0.54	0.44	–0.26	0.02
2. Social class	–0.20		0.17	–0.03	–0.14	0.00	0.28	0.20
3. Church monthly	–0.18	0.11		–0.12	–0.08	0.01	0.29	0.25
4. Socialism	0.38	–0.08	–0.13		0.46	0.39	–0.25	–0.07
5. Medicare	0.43	–0.15	–0.04	0.36		0.39	–0.12	–0.07
6. Trade unions	0.44	–0.06	–0.03	0.36	0.34		–0.08	0.14
7. Private schools	–0.25	0.24	0.23	–0.18	–0.16	–0.07		0.09
8. Age	–0.01	0.01	–0.22	–0.23	–0.14	–0.05	–0.01	
	Females (N = 5388)							

(a) Listwise deletion

the ACE/CE model, the heritability of vote choice for males was zero, with common environment accounting for the majority of variance (0.83), and the heritability of vote choice for females was 0.28 with common environment accounting for 0.52 of the variance.

However, the ACE model that equated all paths for males and females (assuming no sex differences in variance components) did not provide a significantly worse fit (0.053) compared to the full ACE model, and provided a similar AIC as the model removing A from males (Table 5). This model found that the additive genetic factors of vote choice accounted for 24% of the variance and common environment 58% of the variance in both males and females. Due to the marginal significance of the model that equates all paths for females and males, and the possibility that with increased power the confidence intervals would tighten thus making the model significantly different, we cannot state with certainty that the model equating all paths for males and females is the best fitting model for voting behavior. In the univariate analyses either A could be dropped from the model for males or the A, C and E components could be equated between males and females.

Univariate analyses were also conducted for each of the six vote choice correlates previously identified, and ACE models were fitted to estimate genetic and environmental variance components. The saturated ACE model that equated all variance paths for males and females was the best fitting model for church attendance ($a^2 = 0.37$, $c^2 = 0.27$), social class ($a^2 = 0.31$, $c^2 = 0.31$) and attitudes on private schools ($a^2 = 0.19$, $c^2 = 0.26$). However, removing the common environment component from attitudes to socialism ($a^2 = 0.39$), medicare ($a^2 = 0.47$) and trade unions ($a^2 = 0.45$) did not significantly worsen model fit. Models containing both common and unique environmental variances only (CE model) fit significantly worse for all items.

Multivariate analysis

The interpretation of the Cholesky decomposition depends on the ordering of the variables. Accordingly, the ordering depends on the theoretical logic of voting behavior. In our model and as referenced in the extant literature, attitudes are influenced by sociodemographic traits and not vice versa (Campbell et al. 1960; Page and Brody 1972; Martin et al. 1986; Merelman 1986). Therefore sociodemographic traits were placed first. It is widely accepted in the survey research literature that people use a general semantic picture or reference framework to answer specific issue questions (Tourangeau et al. 2000; Sudman et al. 1996). In other words, a general construct incorporates the specific one; but not the other way around. Hence, the construct of socialism was ordered after the sociodemographic traits, but prior to the remaining political issues. The remaining traits were ordered based upon their relative strength of relationship to voting as reported in the discriminant analyses.

Standardized factor loadings for the full Cholesky are shown in Tables 6 (females) and 7 (males). The saturated model assumes that the genetic variation of voting is determined by a genetic component underlying voting as well as all the other variables in the model. In the saturated model, the remaining A and C specific to vote choice were 0 for both females and males, and the specific E (including measurement error) was 0.45 for females and 0.32 for males.

Several reduced models were analyzed (Table 8). Removing the entire additive genetic component (A) or common environment component (C) for all items significantly worsened model fit for both males and females. However, in the saturated model for both males and females, the loadings on the last two genetic paths were near zero, indicating no unique genetic component specific to vote choice, which suggests the model could be further simplified by removing specific genetic paths to vote choice.

Table 5 Standardized variance components (95% CI) sex limitation model fitting for vote choice (Labor versus Conservative); thresholds corrected for age[a]

Model	Parameter estimates						−2LL	ΔX^2	Δdf	AIC	*P*-value (comparison model)
	Females			Males							
	a^2	c^2	e^2	a^2	c^2	e^2					
ACE	0.28 (0.15–0.46)	0.52 (0.36–0.63)	0.19 (0.15–0.25)	0.00 (0.00–0.00)	0.83 (0.63–0.88)	0.17 (0.12–0.22)	7282.45	–	–	−4681.55	–
ACE Females, CE Males	**0.28 (0.15–0.46)**	**0.52 (0.36–0.63)**	**0.19 (0.15–0.25)**	**–**	**0.83 (0.63–0.88)**	**0.17 (0.12–0.22)**	**7282.45**	**0.00**	**1**	**−4683.55**	**0.99 (ACE)**
AE	0.82 (0.78–0.87)	–	0.17 (0.13–0.22)	0.88 (0.82–0.92)	–	0.12 (0.08–.18)	7354.80	72.35	2	−4613.20	<0.001 (ACE)
CE	–	0.73 (0.68–0.77)		–	0.80 (0.74–0.86)	0.20 (0.14–0.26)	7298.90	16.45	3	−4671.10	<0.001 (ACE)
E	–	–	1	–	–	–	8093.16	810.71	4	−3878.84	<0.001 (ACE)
ACE (M = F)	**0.24 (0.10–0.37)**	**0.58 (0.45–0.69)**	**0.19 (0.15–0.23)**	**0.24 (0.10–0.37)**	**0.58 (0.45–0.69)**	**0.19 (0.15–0.23)**	**7290.13**	**7.68**	**3**	**−4679.87**	**0.053 (ACE)**

Note: (a) Preferred models in bold

Removing the seventh additive genetic path to voting provided a significantly worse fit for females ($P = 0.02$), but not males ($P = 0.30$), presenting similar results to the univariate analyses. However, upon further examination of the factor loadings, the socialism factor accounted for the majority of the genetic variance in vote choice. A separate reduction of the model by dropping all genetic paths to voting except socialism provided a non significant chi-square difference compared to the full model for both females and males ($P = 0.97$ and $P = 0.67$ respectively). This model also had a lower AIC (more parsimonious fit) compared to the reduced model that removed all genetic paths to voting for males. Any further reduction of the model by dropping the additive genetic path of the socialism factor to vote choice did not provide a significantly better fit. Therefore the best fitting model for both males and females was the reduced ACE model that removed all the unique additive genetic paths to voting except from the latent additive genetic loading of socialism (Table 8).

Of significant importance, and similar to the additive genetic factor, the final common environment factor loading on vote choice is zero for males and females. Thus the only component of the Cholesky decomposition that provided a specific influence on vote choice is unique environment (Tables 6 and 7). After all other unique environmental variance is accounted for by the vote choice correlates, the unique environment (including measurement error) specific to vote choice accounts for 20% of variance in females and 10% in males.

Discussion

Similar to analyses utilizing earlier rounds of data from the HLQ study, we found that there are genetic, common, and unique environmental variance components to political attitudes (Martin et al. 1986; Truett et al. 1992; Posner et al. 1996). In particular, we found that vote choice is heritable (0.24), but the change in –2LL approached significance ($P = 0.053$), suggesting it was only just possible to equate the variance components for males and females; in the univariate analyses a model where the additive genetic component was present for females but not for males also fit the data.

However, the multivariate results provided a strong indication that the genetic component of voting for both sexes was shared with the same genetic variability influencing its covariates. The difference in AIC

Table 6 Cholesky decomposition standardized path coefficients—saturated model (females)

Additive genetic factor							
	A1	A2	A3	A4	A5	A6	A7
Class	–0.45						
Church	0.18	0.49					
Socialism	–0.14	0.22	0.39				
Medicare	–0.05	0.27	0.26	0.47			
Trade unions	–0.06	0.13	0.15	0.22	0.40		
Private schools	–0.18	–0.12	–0.34	–0.05	–0.11	0.00	
Vote choice	–0.04	0.04	0.44	0.06	0.34	0.00	0.00
Common environment factor							
	C1	C2	C3	C4	C5	C6	C7
Class	–0.66						
Church	–0.02	0.63					
Socialism	0.21	0.07	0.28				
Medicare	0.14	–0.06	0.13	0.22			
Trade unions	–0.02	–0.02	0.38	0.03	0.00		
Private schools	–0.28	–0.16	0.18	0.06	0.36	0.05	
Vote choice	0.32	0.29	0.30	0.39	0.03	0.00	0.00
Unique environment factor							
	E1	E2	E3	E4	E5	E6	E7
Class	0.65						
Church	–0.07	0.52					
Socialism	0.01	0.01	0.77				
Medicare	–0.13	–0.05	0.21	0.68			
Trade unions	–0.05	–0.03	0.21	0.09	0.74		
Private schools	0.08	–0.04	–0.10	–0.08	–0.03	0.71	
Vote choice	–0.14	0.05	0.16	0.21	0.11	–0.06	0.45

Table 7 Cholesky decomposition standardized path coefficients—saturated model (males)

Additive genetic factor							
	A1	A2	A3	A4	A5	A6	A7
Class	–0.60						
Church	0.04	0.33					
Socialism	–0.33	–0.35	0.12				
Medicare	0.04	–0.23	–0.18	0.23			
Trade unions	–0.18	–0.06	–0.21	0.02	0.00		
Private schools	0.02	–0.20	–0.39	–0.15	–0.01	0.00	
Vote choice	0.16	–0.18	0.32	0.16	0.01	0.00	0.00
Common environment factor							
	C1	C2	C3	C4	C5	C6	C7
Class	–0.62						
Church	0.22	0.78					
Socialism	0.30	0.08	0.43				
Medicare	0.34	0.20	0.44	0.11			
Trade unions	0.10	0.14	0.59	–0.17	0.00		
Private schools	–0.42	–0.10	–0.05	0.47	0.00	0.00	
Vote choice	0.34	0.20	0.70	0.11	0.00	0.00	0.00
Unique environment factor							
	E1	E2	E3	E4	E5	E6	E7
Class	0.52						
Church	–0.05	0.47					
Socialism	–0.07	0.11	0.68				
Medicare	0.14	–0.07	0.24	0.64			
Trade unions	–0.12	–0.05	0.15	0.16	0.68		
Private schools	0.15	–0.13	–0.07	–0.14	0.05	0.58	
Vote choice	–0.02	0.03	0.24	0.10	0.12	–0.15	0.32

between models 2 and 3 (see Table 8) in males (4.25 on 1 df) suggests that there is a significant genetic contribution to vote choice through attitudes to socialism and that model 2 only provides an acceptable fit of the data because of the large degrees of freedom for this test. Based on this we have chosen to interpret the multivariate model that includes a genetic covariation between voting and socialism as best representing the patterns of covariation between these variables.

Table 8 Seven-variate Cholesky decomposition genetic model fitting (males and females analyzed separately)[a]

Model	AIC	ΔX^2	Δdf	*P*-value (comparison model)
Females				
ACE	–143.10	–	–	–
ACE (Removed all A to Voting)	–140.54	16.56	7	0.02 (ACE)
ACE (Removed A to Voting except Socialism)	**–153.76**	**1.34**	6	**0.96 (ACE)**
AE	–103.34	92.76	28	<0.001 (ACE)
CE	–141.45	57.65	28	<0.001 (ACE)
E	1220.28	1475.38	56	<0.001 (ACE)
Males				
ACE	–67.76	–	–	–
ACE (Removed all A to Voting)	–73.42	8.33	7	0.30 (ACE)
ACE (Removed A to Voting except Socialism)	**–77.67**	**4.08**	6	**0.67 (ACE)**
AE	93.82	217.58	28	<0.001 (ACE)
CE	–84.46	45.30	28	0.02 (ACE)
E	940.80	1120.55	56	<0.001 (ACE)

Note: (a) Preferred models in bold

There was no evidence that the genetic variability in vote choice was determined by a unique genetic component. Specifically, the best fitting model dropped all the genetic paths to voting except socialism, suggesting an underlying genetic component of voting where the variation is largely accounted for by the latent factor of socialism. Although the HLQ questionnaire asked an opinion on ''socialism,'' the term was not defined. Therefore we must take care elaborating on its meaning. Based upon socialism's strong correlation with medicare and trade unions one could speculate that it is a substitute for social responsibility. However, an alternative explanation could be that negative attitudes toward socialism are a proxy for lack of support for handing over individual responsibilities to government control or collectives (unions). Therefore, for Australian voters the additive genetic component of voting is likely related to either social responsibility or personal accountability.

In addition to the genetic examination of voting, the common environment component is also entirely accounted for by the first six elements of the model in both males and females. It is widely assumed in the political science literature that the common (family) environment is the major source of political partisanship and voting behavior (Campbell et al. 1960). However, while common environment accounted for a significant portion of the variance in the univariate analyses, the multivariate results provide no evidence of a specific common environmental influence on vote choice. Rather, the common environment component is part of an overall construct that influences one's attitudes and voting preferences. Further confounding the issue, previous studies found the common environment component of certain social and political items was to a great extent attributable to assortative mating (marrying alike) and not familial socialization (Eaves et al. 1999). Thus, as we found an additive genetic component in voting (accounted for by its covariates), but no common environment component specific to voting, the first of our theories, the socio-psychological model (common environment specific to voting) was not supported by the data used here.

Indeed, unique environment was the only residual variance specific to vote choice, lending some support to existing voting studies that focus on the unique environment (Zaller 1992). However, it is unclear what part of this variance (up to 20%), is free will or simply measurement error.

While these findings do not disprove the rational choice theory of voting behavior, we can make a strong argument that rational choice is incomplete. The underlying voting factor does have a heritable component (up to 0.28) as did the individual political items that accounted for voting's additive genetic component in the multivariate analyses. As such, it appears that rational choice is a plausible vote choice model, but only if the ''black box'' of preferences allows for a genetic component and the theory relaxes the requirement that people must be aware of their genetic preferences. In other words, genes may provide the framework for evaluating voting alternatives and making the ''rational'' choice.

The present study has several important limitations. The use of the phrases ''*Generally speaking*'' and ''*usually*'' in the question used to assess vote choice implied discounting the current election or any unique environmental circumstances. The question did not ask how respondents specifically voted in the last election, but rather how they normally vote. As such, phrasing of the question may reduce specific election year environmental fluctuations. A second limitation is the

nature of Australian politics during the year surveyed. Minority party support was at a record high in 1990. By 2006 Australian politics have largely returned to a two-party system, justifying the removal of the Democrats from the analyses, but this removal also reduced our sample size by about 5%. In order to ensure that this exclusion did not distort our results we ran separate analyses combining the Democrats with the Conservatives, which resulted in only minor differences in our findings. Finally, we utilized covariance matrices computed by PRELIS 2 so only pairs with complete data contributed to the multivariate analyses. This was done because of the numerical problems and extremely long run times that frequently beset multivariate analyses with large numbers of categorical variables. We validated the multivariate findings by verifying that the Cholesky component results fell within the confidence intervals of the univariate analyses, which were performed using raw data.

Conclusion

Previous genetic studies examining political traits have been limited to attitudes (Martin 1987; Eaves et al. 1989; Truett et al. 1992). Missing in the extant literature are examinations of political actions and behaviors, such as voting. While traditionally the social sciences have viewed twin studies as only a means to proscribe additive genetic influence, twin data also provide a means to partition out environmental variance into that which is common to members of a family and that which is unique to the individual, thus allowing political scientists a technique to examine different sources of preferences and validate existing theories.

However, classical twin design analyses may not be always be appropriate for establishing the source of heritability in political behaviors; the act of voting is only part of the complex interdependent and context dependent social attitude factors that are both genetically and environmentally influenced (Martin et al. 1986; Zaller 1992; Hermann 2002). Utilizing other methodologies including the extended twin family design (ETFD) will also undoubtedly provide further insight. The ETFD's use of more parameters allows for the simultaneously estimation of common environment and non-additive genetic effects, as well as assortative mating. The next step logical step in this analysis is to apply the ETFD to the analysis of vote choice. Given the relative absence of studies conducted on genetic influences on political behavior, our findings present an important examination of genetic influences on vote choice, and a significant contribution to the literature that may have substantial implications for future research in this area.

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References

Akaike H (1987) Factor analysis and AIC. Psychometrica 52:317–332

Alexander RD (2004) Evolutionary selection and the nature of humanity. In: Hosle V, Illies C (eds) Darwinism and philosophy. University of Notre Dame Press, Notre Dame, pp 424–495

Alford J, Funk C, Hibbing J (2005) Are political orientations genetically transmitted? Am Polit Sci Rev 99(2):153–167

Alford J, Hibbing J (2006) Investigating the genetic transmission of political attitudes and behaviors. Proposal to the Political Science Program of NSF

Baker LA, Trelaor SA, Reynolds CA, Heath AC, Martin NG (1996) Genetics of educational attainment in Australian twins: sex differences and secular changes. Behav Genet 26:89–102

Bouchard T, Segal N, Tellegen A, McGue M, Keys M, Krueger R (2003) Evidence for the construct validity and heritability of the Wilson Patterson Conservatism Scale: a Reared Apart Twins Study of Social Attitudes. Pers Indiv Differ 34:959–969

Bruell J (1970) Heritability of emotional behavior. In: Black P (ed) Physiological correlates of emotion. Academic Press, New York

Campbell A, Converse PE, Miller WE, Stokes DE (1960) TheAmerican voter. Wiley, New York

Carmines EG, Stimson JA (1980) The two faces of issue voting. Am Polit Sci Rev 74:78–91

Cook TE (1985) The bear market in political socialization and the costs of misunderstood psychological theories. Am Polit Sci Rev 79:1079–1093

Corning P (1971) The biological bases of behavior and some implications for political science. World Polit 23(2):321–370

Curtin J (1998) The gender gap in Australian elections, Research Paper no. 3. Parliamentary Research Service, Canberra

Darwin, C, n.d. (1859, [1871]). The origin of species and the descent of man. The Modem Library, New York

Downs A (1957) An economic theory of democracy. Harper, New York

Druckman JN (2001) The implications of framing effects for citizen competence. Polit Behav 23:225–256

Druckman JN (2004) Political preference formation: competition, deliberation, and the (ir)relevance of framing effects. Am Polit Sci Rev 98:671–686

Durkheim E (1895 [1964]). The rules of sociological methods. Free Press, London

Eaves LJ, Eysenck HJ, Martin NG (1989) Genes, culture and personality; an empirical approach. Academic Press, London

Eaves LJ, Heath AC, Martin NG, Maes HH, Neale MC, Kendler KS, Kirk KM, Corey LA (1998) Comparing the biological and cultural inheritance of stature and conservatism in the kinships of monozygotic and dizygotic twins. American Psychopathological Association Yearbook

Eaves L, Heath A, Martin N, Maes H, Neale M, Kendler K, Kir K, Corey L (1999) Comparing the biological and cultural inheritance of personality and social attitudes in the Virginia 30 000 study of twins and their relatives. Twin Res 2:62–80

Grattan M (ed) (2000) Australian Prime Ministers. Frenchs Forest, NSW

Heath AC, Slutske WS, Bucholz KK, Madden PAF, Martin NG (1997) Behavior genetic methods in prevention research: an overview. In: Bryant KJ, Windle M, West SG (eds) The science of prevention: methodological advances from alcohol and substance abuse research. American Psychological Association, Washington DC, pp 123–163

Hermann, MG (2002) Political psychology as a perspective in the study of politics. In: Monroe KR (ed) Political psychology. LEA, Mahwah, NJ

Iyengar S, Kinder DR (1987) News that matters: television and American opinion. University of Chicago Press, Chicago

Jaensch D (1989) Power politics: Australia's party system, 2nd edn. Sydney

Jardine R, Martin NG (1984) No evidence for sex-linked or sex-limited gene expression influencing spatial orientation. Behav Genet 14:345–354

Jöreskog K, Sörbom D (1999) LISREL 8 USER's guide. University of Uppsala, Uppsala, Sweden

Kendler KS, Walters EE, Truett KR, Heath AC, Neale MC, Martin NG, Eaves LJ (1995) A twin-family study of self-report symptoms of panic-phobia and somatization. Behav Genet 25:499–515

Landemore H (2004) Politics and the economist-king: is rational choice theory the science of choice? J Moral Philos 1(2):177–197

Lichbach MI (2003) Is rational choice theory all of social science? University of Michigan Press, Ann Arbor

Loehlin JC (1996) The Cholesky approach: a cautionary note. Behav Genet 26(1):65–70

Loehlin JC (1998) Latent variable models: an introduction to factor, path, and structural analysis, 3rd edn. Lawrence Erlbaum Associates, Mahwah, NJ

Martin NG, Martin PG (1975) The inheritance of scholastic abilities in a sample of twins. I. Ascertainment of the sample and diagnosis of zygosity. Ann Human Genet 39:213–218

Martin NG, Eaves LJ, Heath AC, Jardine R, Feingold LM, Eysenck HJ (1986) Transmission of social attitudes. Proc Natl Acad Sci 83:4364–4368

Martin NG (1987) Genetic differences in drinking habits, alcohol metabolism and sensitivity in unselected samples of twins. Genetics and Alcoholism. G. H. W. and A. D. P. New York, Alan R. Liss, 109–119

Masters RD (1990) Evolutionary biology and political theory. Am Polit Sci Rev 84(1):195–210

Merelman RM (1986) Revitalizing political socialization. In: Herrmann R (ed) Political psychology. Jossey-Bass, San Francisco

Miller JM, Krosnick JA (2004) Threat as a motivator of political activism; a field experiment. Polit Psychol 25:505–523

Moon J, Sharman C (2003) Australian politics and Government: the Commonwealth, the States and the Territories. Cambridge University Press, New York

Neale MC, Cardon LR (1992) Methodology for genetic studies of twins and families. Kluwer Academic Publishers, Dordrecht, The Netherlands

Neale MC, Boker S, Xie G, Maes H (2003) Mx: statistical modeling, 5th edn. Department of Psychiatry, Virginia Commonwealth University, Richmond, VA

Nelson TE, Clawson RA, Oxley Z (1997) Media framing of a civil liberties controversy and its effect on tolerance. Am Polit Sci Rev 91(3):567–584

Nelson TE (2004) Policy goals, public rhetoric, and political attitudes. J Polit 66:581–605

Newman G (1996) Federal election results 1949–96, Background Paper no. 1. Parliamentary Research Service, Canberra

Olson J, Vernon P, Jang K (2001) The heritability of attitudes: a study of twins. J Personal Soc Psychol 80(6):845–860

Page BI, Brody RA (1972) Policy voting and the electoral process: the Vietnam war issue. Am Polit Sci Rev 66:9769–9995

Page B, Jones C (1979) Reciprocal effects of policy preferences, party loyalties and the vote. Am Polit Sci Rev 73:1071–1090

Popkin SL (1991) The reasoning voter. University of Chicago Press, Chicago

Posner SF, Baker LA, Heath AC, Martin NG (1996) Social contact; social attitudes and twin similarity. Behav Genet 26(2):123–134

Sapiro V, Rosenstone SJ, the National Election Studies (2002) American National Election Studies Cumulative Data File, 1948–2000 [Computer file]. 11th ICPSR version. Ann Arbor, MI: University of Michigan, Center for Political Studies [producer], 2002. Ann Arbor, MI: Inter-university Consortium for Political and Social Research [distributor], 2002

Sears DO (1989) Whither political socialization research? The question of persistence. In: Ichilov O (ed) Political socialization, citizenship education, and democracy. Teachers College Press, New York

Sigelman L (2006) Report of the editor of the American Political Science Review, 2004–5. PS: Polit Sci Polit 40:171–173

Simms M (ed) (1996) The paradox of parties: Australian political parties in the 1990s. St. Leonards, NSW

SPSS Inc. (2003) SPSS for Windows (Release 13.0). [Computer Software]. SPSS Inc., Chicago

Sudman S, Bradburn N, Schwarz N (1996) Thinking about answers: the application of cognitive processes to survey methodology. Jossey-Bass, San Francisco, CA

Tooby J, Cosmides L (1992) The psychological foundations of culture. In: Barkow JH, Cosmides L, Tooby J (eds) The adapted mind: evolutionary psychology and the development of culture. Oxford University Press, Oxford

Tourangeau R, Rips LJ, Rasinski K (2000) The psychology of survey response. Cambridge University Press, Cambridge

Truett KR, Eaves LJ, Meyer JM, Heath AC, Martin NG (1992) Religion and education as mediators of attitudes: a multivariate analysis. Behav Genet 22(1):43–62

Ward I (1990) The political chronicle: Australia January–June 1990. Aust J Polit Hist 30(3):242

Warhurst J (ed) (1997) Keeping the bastards onest: the Australian democrats first twenty years. NSW Editors, St. Leonards

Whitfield JB, Zhu G, Madden PAF, Neale MC, Heath AC, Martin NG (2004) The genetics of alcohol intake and of alcohol dependence. Alcoholism: Clin Exp Res 28:1153–1160

Whitfield JB, Zhu G, Heath AC, Martin NG (2005) Choice of residential location: chance, family influence, or genes? Twin Res Human Genet 8:22–26

Wilson GD, Patterson JR (1968) A new measure of conservatism. Br J Soc Clin Psychol 7:264–269

Wilson EO (1998) Consilience: the unit of Knowledge. Alfred knopf, New York

Zaller JR (1992) The nature and origins of mass opinion. Cambridge University Press, Cambridge