It's the End of Ideology as We Know It

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Abstract: Scholars have long focused on socio-psychological attachment, elite discourse and rational action to explain the nature and structure of ideologies. Recently genetic and neurobiological influences have also emerged as predictors of ideological preferences. So far however, there has been little synthesis of these findings into the larger discourse on the structures and manifestations of ideology. The few studies which do include genetic sources of information imply that culture is merely a passenger on a genetic foundation. Here, we test this assumption and in doing so offer a foundation for merging social, psychological, rational and biological theories of attitude formation and structure. Utilizing a genetically informative sample, we find striking differences between the genetic and environmental factor structures of inter-related attitudes which form ideologies. The structure imposed by social influences corresponds to recognized definitions of liberalism and conservatism on a left-right continuum; however the genetic factor structure combines liberal attitudes toward sex and reproduction with conservative attitudes toward punishment, defense and immigration. That is, the structure imposed on social and political attitudes by the social environment is a cultural veneer laid on a potentially *divergent* underlying structure of genetic differences. Our findings should encourage a new understanding of ideology that encompasses genetic, individual, and cultural mechanisms that operates in both conflict and concert depending on local and temporal contexts.

What is ideology? Is there a coherent structure of political attitudes and beliefs? Two approaches, one focusing on socio-psychological factors and the other on rational action and elite cues, have governed the theoretical explications of ideology, including its nature, origin, maintenance, manifestation, structure, purpose and function. There has been increased dialogue between these approaches attempting to create a more comprehensive understanding of ideology (Hetherington and Weiler 2009; Treier and Hillygus 2009). However, a third paradigm has also emerged. Combined evidence from genetic, neurological, physiological, and hormonal studies have shown that ideological preferences result from more than learned behavior. Rather, the psychological constructs that appear to govern political preferences and ideological structure, whether a super factor of attitudes (i.e., ideology) or self-reported liberal-conservative ideology, are genetically influenced. In this view, while the global environment sets the range of possible attitude positions, individual differences within a given society remain a function of genetic influences and unique experience that operate through a neurobiologically informed psychological architecture (Martin et al. 1986; Eaves, Eysenck and Martin 1989; Bouchard et al 1990; Hatemi et al 2010; Verhulst, Hatemi and Martin 2010).

However, studies which have included genetic mechanisms have only focused on preferences regarding individual attitudes, or a summarized attitudinal (ideological) scale. They have not explored the relationship between attitudes, or the structure of ideology through a genetic and environmental lens. Thus, the extant literature has relied on the assumption that the measured ideological construct, the summation of all individual attitudes in most cases, accurately reflected *both* the proper genetic and cultural structures. No one has yet asked whether socially defined ideological constructs actually correspond directly to any underlying genetic structure, or whether they may instead represent purely environmental constructs emancipated

from, or even in conflict with, latent patterns of genetic variation. Rather, it has simply been assumed that genes and the environment operate directly in concert, and that attitude constructs align in similar ways at both the genetic and social level to create the expressed social and political attitudes we typically recognize as ideology. In this way, most existing models assume that culture is merely a passenger on a genetic foundation. That is, biology and environment simply work in unison, pulling on the same oar and moving together toward the same destination. But what if this assumption is not correct? What if genetic and cultural structures reflect fundamentally different imperatives? For example, attitudes against abortion and for the death penalty, while logically linked at a societal level in ideological political platforms espoused by elites, may not actually cohere in the same way on a genetic level. Instead, these two attitudes may develop from fundamentally different origins, imperatives and mechanisms.

Thus, if it is the case that some combination of genes carry and transmit behavioral propensities across generations, however indirectly, these influences may express themselves in diverse and contingent ways within particular cultural and environmental contexts across time and space. However, by only looking at the expressed trait values and variance decomposition of individual items or summation of individual items, we may be missing important insights about how attitudes are related to one another at genetic and environmental levels. We suggest that different characterizations of ideological dimensions may emerge when genetic and environmental influences on attitudes are separated into discrete factor structures. By doing so, we may have an opportunity to integrate previously disparate, and at times apparently contradictory, findings to provide a synthetic view concerning the ontological foundation of ideology.

Genetic influences must be integrated into frameworks which account for cultural and

societal change and as much as biological and psychological mechanisms may be able to reconcile the stability of some attitude structures as opposed to others, so too do social influences make the findings in genetics and biology coherent. That is, deeper mechanisms related to basic issues of survival and procreation endure at a genetic level, while at the same time groupings of attitudes remain culturally bound amalgams of the day, and move as the times and culture shift. These more culturally transient attitudes may appear to have little immediate bearing on biological imperatives; however, they may nonetheless access other deeper psychological processes on which they rest, such as empathy or fear.

Indeed, modern political issue positions, involving sex and reproduction (e.g., abortion, casual sex) as well as those involved in defense against out-groups (e.g., immigration) and survival (e.g. military defense from territorial invasion), do appear more stable, have greater consistency with each other than other attitudes (e.g., property tax), and appear somewhat universal in their discrimination between what is considered liberal or conservative across cultures (Hofstede 2001; Schwartz 2006). This makes sense. While no single gene alone directs complex behaviors, we would expect to see common themes related to topics such as sex and defense work precisely through those adaptive processes underlying evolutionary stable psychological mechanisms used to evaluate issues and make decisions related to fitness. Environmental cues and triggers will then differentially elicit those epigenetic mechanisms within the universal architecture of adaptive responses designed by natural selection. Similar processes were likely used to solve the repeated social and "political" dilemmas related to species survival in the past. If our view proves correct, it becomes impossible to view ideology as simply a cultural grouping of attitudes in isolation from biology, nor as a passenger on a biological train. Rather, ideology emerges as a complex interweaving of distal, biologically

informed and genetically transmitted dispositions with the strands provided by the proximate socially and culturally infused threads of the day. These factors may at times work in union, or act in opposition, depending on the nature of the times and society in which one lives.

Furthermore, integration of genetic approaches remains crucial to a comprehensive understanding of the etiology of ideology because it can offer the one element most formal models of political behavior lack or remain agnostic to, potential sources of preferences. Thus, while the current literature has begun to recognize that the combination of socio-psychological, rational and genetic elements have some role in ideological formation, the main assumptions underlying each approach have not yet been reconciled in light of one another, nor merged into a cohesive whole, specifically in determining the structure of attitudes. That is, mainstream theories of ideology, whether social, psychological or rational, currently lack the theoretical mechanisms to account for genetic sources of ideological development and have yet to fully incorporate the genetic contributions to explain the development of ideological formation. At the same time research identifying neurobiologically informed preferences lacks conceptual clarification when viewed alone. That is, genetic and neurobiological findings must be integrated into frameworks which account for cultural and societal change and rational behavior as well. In this way biological elements never act in isolation from environmental context. In summary, individually, current models of behavior do not provide a comprehensive understanding of the full complement of factors which are known to contribute to the development of ideological formation and attitude structure.

Therefore, in this paper, we seek to lay the groundwork for combining social, psychological, rational, and biological paradigms to explain attitude formation and structure. We do so by taking advantage of a behavior genetic approach and method which allows for the

exploration of attitudinal structure at socio-psychological, rational, and genetic levels. Specifically, by utilizing a genetically informative sample , surveyed on a broad index of political attitudes, we estimate the genetic, social and unique environmental *factor structures* of attitudes. Rather than consider ideology as a multidimensional trait with a single level of structure, we posit that the multidimensional attitude *structures* imposed by environmental influences may not be identical to the *structures* imposed by genetic effects in producing modern political ideologies. Instead, these structures may emerge from different sources, and operate in distinct ways, which may or may not overlap, to create a broader construct, which we typically call "ideology."

We begin with a review of existing attitudinal approaches to ideology, and in doing so attempt to reconcile disparate theories by identifying their core assumptions and then explore whether these assumptions hold true in view of one another. We do this through an exploratory analysis which separates the factor structure independently imposed by genetic, familial and environmental influences. In doing so, we provide an empirically valid foundation upon which to build a coherent integrated theory which might incorporate those elements of social, rational and genetic perspectives.

Ideology as We Know It

A great deal of debate exists regarding the nature, structure and construction of ideology, and how many dimensions are needed to properly characterize individuals' beliefs. The perspective introduced by Converse and colleagues (Campbell et al. 1960), posits an explicit overarching left-right continuum along which potential voters might be placed. Children learned their partisan political identification at the knees of their parents as the result of affective attachments, often without understanding why they support particular policy positions (also see

Jennings and Niemi 1968). In Converse's (1964) conceptualization, most individuals do not hold stable attitudes or espouse a collection of beliefs consistent with elite driven understandings of ideology. However, a consensus within more recent explorations found that the mass publics have more structure and consistency than Converse portrayed (Feldman 1988; Peffley and Hurwitz 1985). Additional work also highlighted the importance of issue salience in explaining response instability in attitudes (Zaller and Feldman 1992). From this perspective, attitudes were seen as "a distillation of a person's lifetime experiences, including childhood socialization and direct involvement with the raw ingredients of policy issues..." (Zaller 1992: 23).

Meanwhile, scholars working largely in the tradition of social psychology examined the structure of political attitudes and ideology from a more psychologically oriented perspective (Adorno 1950; Eysenck and Wilson 1978; Jost et al. 2008). Prominent in this view, ideology rested on the notion of uncertainty, and differences in the level of anxiety individuals experienced when confronting uncertainty (Wilson 1973; Jost et al. 2003). This approach also found consistent sets of attitude groupings across cultures that defined conservatism (Hofstede 2001). However, political attitudes did not necessarily converge into a single coherent overall ideology across a typical left-right divide as recognized by elites, but rather existed as more subjective, discrete attitudes, specific to particular positions, and embedded in deeper psychological and familial tendencies (Caprara et al 2006; Jennings and Niemi 1968; Jost 2006). Thus, attitudes formed fairly consistent ideologies within individuals and nuclear families, and remained somewhat stable over time.

Psychological and behavioral approaches do overlap, however, psychologists tend to focus more on individual differences, personality, and specific combinations of attitudes, while political scientists largely follow socio-psychological or rational action approaches and favor

explorations grounded in socialization, self-interest, elite discourse, and other aggregate level indicators to examine the construction of a larger left-right ideological continuum.

Over the last several years, the dialogue and interaction between socio-psychological and rational approaches has increased, and several research streams have begun to merge the two areas (Knight 2006; Hamilton 1987). For example, Gerring (1997), along with others, note the many different definitions of ideology which derive, in part, from different forms of measurement and theoretical constructions of its purpose and meaning. Indeed, the various operationalizations, terminologies, and intellectual histories deriving from sociological, political, psychological, cognitive and affective aspects of ideology reflect the multi-dimensional nature of ideology and the important ontological differences in the very definition of ideology. Thus, while multiple definitions of ideology exist, encompassing egalitarianism, moral regulation, individualism, equality, authoritarianism and social dominance orientation (Ashton et al., 2005; Duckitt 2006; Rokeach, 2000; Stangor and Leary 2006), for current purposes, we rely on the definition of ideology consistent with the majority of contemporary studies of the American electorate. This definition of ideology conceptualizes a multidimensional constellation of attitudes, largely structured around social, economic, and foreign policy/defense dimensions (Campbell et al 1960; Conover and Feldman, 1984; Converse 1964; Treier and Hillygus 2009).

Regardless of how ideology is measured, the majority of explorations have remained focused on environmental influences, such as issue salience or socialization, in determining attitude formation and ideological consistency. So far, there has yet to be a reconciliation of approaches to explain why we find some stable attitude groupings which remain consistent across cultures, while many attitude clusters appear more unstable across time and region. This is of particular interest because the consistent nature of many of the attitude subfactors which

define ideology reflect evolutionarily adaptive themes, including those related to sex and defense (Hatemi, Medland and Eaves 2009; Oxley et al. 2008). And a growing body of literature has begun to point toward biological sources of ideological preferences (e.g., Martin et al. 1986). It is to these genetic and biological influences we now turn.

Genetic Approaches to Ideology

Over the last 40 years, genetic (e.g., Martin et al 1986), physiological (e.g., Tesser et al. 1998), hormonal (e.g., McDermott et al. 2009) and neurological (e.g., Amodio et al. 2007) influences on political attitudes and ideologies have emerged. This research program is relatively new to the social sciences, and despite an increasing number of studies in this vein (for a review see Hatemi et al. 2011), there has been little attempt to integrate biological and social paradigms into a synthetic understanding of complex political preferences and ideologies. While processes of socialization (Jennings and Niemi 1968) and rational action (Zaller 1992) are well known, most of the political science literature has not yet fully incorporated biological approaches. Therefore, it proves useful to provide some discussion of genetic pathways by which human similarities and differences emerge, and explicate how biology and the environment interact to form and express political preferences and ideologies.

Ideologies, attitudes and political behaviors could not exist without an essentially "human" cultural milieu (Eaves and Eysenck 1974). Lumsden and Wilson (1981) argue that research into human culture and social behavior is grounded on the theory of the "Promethean Genotype"; that is, humans are emancipated by evolution from any dependence on their biological past. Such a restricted view has ignored the possibility that social behavior might depend on flexible but innate perceptual and evaluative human characteristics, such as the mechanisms by which we learn (i.e., "epigenetic rules"), processes that owe their very existence

to ancestral evolutionary advantage. Such emergent rules do not themselves constrain humans to the unexamined adoption of specific inherited behavior patterns, but rather provide the toolkit people use to evaluate and learn from their environment as a prelude to making decisions or expressing preferences in the face of new information. However there is remarkable variation in the operationalization of these mechanisms. Within the context of modern day political attitudes, these mechanisms can be grouped for example, into more basic human behaviors such as a willingness to cooperate in finding food or shelter, defending against out-groups, or selecting a mate. The intensity of such behavioral propensities was likely to have been passed along to progeny (Petersen and Kennair 2009). As a result, the same processes which may have influenced attitudes related to protecting in-group members from out-groups in our ancestral past, or those involved in mating and reproduction, may find some commonality in modern, albeit more complex, traits such as illegal immigration, divorce, or abortion. Importantly, such a view does not presume that all humans are universally the same. Rather, the core design features may be the same for all humans, but critical, genetic differences within and across populations may have emerged due to differences in such factors as mate choice, in-migration, and differences in local ecology, thus accounting for endless individual genetic variation.

The inclusion of genetic influences does not presume the existence of a fixed disposition of any particular attitude because context, both internal and external to the organism, remains critically important; successful adaptation for any species depends in part on the flexible ability to accommodate to changing environmental circumstances. Genes can, and do, express themselves in the context of modern political attitudes, but not necessarily in direct or obvious ways. Genes should not be expected to encode specific political preferences or what modern political scientists would recognize as underlying attitude constructs toward issues defined by a

particular time and culture. An intransigent psychological architecture would not prove efficient for an organism which must be able to flexibly adapt to a variety of environmental contingencies and local ecologies. Certainly, there are no such things as core or baseline individual attitudes that are "genetic". Despite claims in the popular media (Kaplan 2010), there is no such thing as a gene for liberalism or conservatism. Indeed, even a left-right spectrum that defines ideology in the public sphere represents a cultural product.

Individual genes do not have a direct causal role in any complex social behavior. No credible theory of human behavior assumes that there is "a" gene "for" being republican or democrat, liberal or conservative, catholic, protestant or atheist, or any complex social trait. Nor can any credible theory argue that there are hard wired political preferences, or that we are simply born with particular positions on specific issues. Instead, genes provide the platform for the synthesis of proteins which then trigger neurological, physiological and hormonal processes which have cognitive and emotional consequences that guide behavior. Thus genes do not "determine" behavior. Rather, genes influence behavior indirectly, and behavior in turn influences gene expression, which then instigates neurochemical processes that interact with the environment in a reciprocal manner to continually modify behaviors.

This perspective highlights the continuous and complex interplay between all the processes that occur prior to birth, such as hormones introduced in-utero, social upbringing, and the experiences encountered during childhood, including emotional support, diet, and exposure to toxins which in turn influence neurological development and regulate the expression of genes to ensure healthy emotion regulation and cognition. The process is not linear, but circular and interactive; there are a multitude of pathways which can influence any given behavior. Preferences or behaviors may change as environments shift and social incentives change. In this

way, individuals select into, or alter, the environments in which they operate, leading to feedback loops between biology and environment.

While the range of political preferences and attitude groupings available are embedded within a specific social and cultural context, (e.g., one cannot have an attitude on whether or not to support warrantless wiretapping in a country with no phones), the preferences or behavior expressed within those confines can be, in part, influenced by biological mechanisms and dispositions. The underlying theoretical foundation of any study of human behavior recognizes that biology operates in concert with environmental factors, both those experiences shared with others, and those unique to the individual, across numerous developmental stages (e.g., puberty, menopause, etc.). For a more detailed explication of the role of genes in complex social behaviors, the reader is referred to the introduction of this special issue.

Combining Political Science, Biology and Psychology

Summarizing the above extant literature regarding the structure of ideology and the relationship between attitudes, we note that: 1) S*ocialization* approaches suggest that the factor structure of attitudes, recognized as either liberal or conservative, is due to familial or social forces (see Campbell et al 1960; Converse 1976; Jennings and Niemi 1968); 2) *rational or self-interested* approaches focus on a factor structure of attitudes provided by elite discourse. These two approaches are compatible. Thus, the *combined socio-rational* assumption assumes that ideological structure, while multidimensional, exists on a single level of analysis; 3) *genetic, evolutionary and biological assumptions*, however, are not consistent with the assumptions above. Rather, a coherent *genetic factor structure* should reflect the grouping of enduring adaptive mechanisms. In a political context, genetic relationships should emerge for issues that

are culturally defined as liberal in pro-creation, but conservative in areas of defense and out-groups (Lumsden and Wilson 1975; Barkow, Cosmides and Tooby 1992; Peterson 2009).

The assumptions underlying the three approaches have remained largely independent of one another because until recently, it was not empirically feasible to separate environment from biology in a meaningful way. However, the introduction of biometric theory in the mainstream political science literature has opened the door for such an approach to begin. Here we provide just such an empirical exploration. Note that in our examination, we hope to reconcile the relevant assumptions undergirding current theories, thereby allowing for a more coherent, cohesive, and empirically grounded approach to study ideology. We focus in particular on the attitudinal structure definition of ideology, and evaluate each set of assumptions undergirding the social, environmental and genetic approaches in the context of each other. In this way, we let the data tells us whether, and how, we might integrate existing theories.

Thus, if we are to integrate social, psychological, rational and genetic theories, it becomes necessary to consider the possibility that ideology is not a multidimensional trait with a single level of structure, but rather a multidimensional, multi-level construct. That is, in order to more fully understand ideology, we must examine the *structure* of attitude groupings imposed by environmental influences (whether social or individual) and the *structure* of attitude groupings imparted by genetic heritability. We do this by pulling apart the factor structure of attitudes to explore whether in fact social and genetic attitude structures are competing, complimentary or unrelated.

Unfortunately, no one method can capture the entire biological contribution to the structure of attitudes and the nature of ideology. However, biometric variance decomposition, which focuses on individual differences within a population, and partitions sources of variation

into discrete elements of genes and environment, is in many regards ideal to categorize the structure of attitudes and the nature of ideology from social, rational, and biological perspectives. The most common form of variance components modeling, the classical twin design, partitions the variance of a trait into three elements: shared environmental; unique environmental; and genetic influences (Medland and Hatemi 2009).

In order to identify if there are different levels of ideological structure and if current assumptions in the social, rational and genetic approaches are consistent with one another, we first examine the relative contribution of genetic (A), shared environment (C), and unique environmental influences (E) for each individual political and social attitude and preference we seek to explicate. In most respects, this first step is a replication of existing findings (e.g., Eaves et al 1999; Martin et al 1986). This process explores the genetic underpinnings of the more universal political ideology described by Campbell et al. (1960) and others. Then we separate the factor structures which derive from genetic influences from those which remain environmentally defined and conceived. Environmental factor structures (social and unique to the individual) should reflect the various insights with regard to specific attitude structures outlined in the extant political science literature (e.g., Adorno 1950; Conover and Feldman 1981; Jost et al. 2003; Zaller 1992). Genetic factor structures should reflect those identified in the evolutionary literature, regarding procreation and survival (Lumsden and Wilson 1975; Barkow, Cosmides and Tooby 1992; Petersen and Kennair 2009). By identifying both genetic and environmental factor structures, we can begin to identify the environmental and biological layers of attitude *groupings*, not just the decomposition of individual attitudes themselves. In this way individual expression of ideology (attitude groupings) can emerge as a combination of genotype, social and unique environmental influences.

METHODS

The data comprise the responses of 4,816 same-sex pairs of adult twins assessed during a health, personality and attitudes study of the extended kinships of twins from the Mid Atlantic Twin and Family Registry. The study originally included mixed-sex twin pairs and the parents, spouses, siblings and adult children of twins, and was designed specifically to resolve the relative roles of cultural and biological inheritance and mate selection on the transmission of a wide range of health-related and behavioral variables (Eaves, Eysenck and Martin 1989). The ascertainment and structure of the sample are summarized by Eaves et al. (1999). This study relies on the responses of 1,950 pairs of monozygotic female (MZF) twins, 1,240 dizygotic female (DZF) pairs, 813 monozygotic male (MZM) pairs, and 608 dizygotic male (DZM) pairs.

Political attitudes were assessed by 28 items from a Wilson-Patterson (1968) Liberalism-Conservatism scale, developed using items that were especially salient (e.g. "abortion", "school prayer", etc.) in the United States at the time of the study (1986-1987). The items were incorporated as a single section in a larger "Health and Life-Styles" Survey (HLS) under the label "Attitudes" (Web Appendix 2). The multi-attitudinal Wilson-Patterson *conservatism-liberalism* ideology index in our data is equally predictive of party affiliation as compared to the National Election Studies (NES) self-report measure for the same years in which our sample was taken (Hatemi and McDermott 2009). In addition, it is significantly more stable. It has also been found to be highly correlated with self-reported ideology in a more recent sample (Smith et al. 2012).

Based on a preliminary factor analysis of the categorical item responses conducted in M-plus (Muthen and Muthen 2000) seven items were reflected prior of the model-fitting analysis to simplify interpretation of subsequent factors. Items reflected were those relating to the death penalty, the draft, military drill, segregation, the moral majority, censorship and school prayer.

Despite some 20 years passing since the initial survey, the political relevance of each of these topics, and the amount of media coverage devoted to them, remains remarkably consistent with the politics of today.

Model

We follow the basic approach for estimating genetic and environmental covariances described by Neale and Cardon (1992). The specifics of biometric variance decomposition are explicated in detail for political science in Medland and Hatemi (2009); specific examples in the literature include explorations of ideology and attitudes (Hatemi et al 2010), voter turnout (Fowler, Baker and Dawes 2008), personality (Verhulst, Hatemi and Martin 2010), partisanship (Hatemi et al 2009) and trust (Sturgis et al 2010). For each group of twins, the responses of members were paired, generating a total of 56 responses per twin pair, comprised by the 28 responses of the first twin added to the 28 responses of the second twin. 56 x 56 matrices of the polychoric correlations between items, within subjects, and across members of twin pairs, were computed using SAS version 9.13. For these analyses, let **P** denote the phenotype, or measured trait of interest, attitudes in these analyses. Let $\mathbf{R_{MZ}}$ denote the observed (56 x 56) matrix of polychoric correlations within and between monozygotic (MZ) twins for the 28 attitudes, and $\mathbf{R_{DZ}}$ denote the corresponding matrix for dizygotic (DZ) twins. Let **G** be the (28 x 28) matrix of (additive) genetic covariances, **B** the (28 x 28) matrix of shared (between family members) environmental covariances and **W** the (28 x 28) matrix of covariances of unique (within-family members) environmental covariances. The (28 x 28) phenotypic covariance matrix is expected to be

$$\mathbf{P} = \mathbf{G} + \mathbf{B} + \mathbf{W}$$

subject to the constraint that diag(**P**) = **I**.

The expected correlation matrix for MZ twins is then the partitioned matrix

$$E\{\mathbf{R_{MZ}}\} = \begin{array}{c|c} \mathbf{P} & \mathbf{G+B} \\ \hline \mathbf{G+B} & \mathbf{P} \end{array}$$

and

$$E\{\mathbf{R_{DZ}}\} = \begin{array}{c|c} \mathbf{P} & \mathbf{\frac{1}{2}\,G+B} \\ \hline \mathbf{\frac{1}{2}\,G+B} & \mathbf{P} \end{array} \quad .$$

The matrices **G, B** and **W** are constrained to be positive (semi-)definite by writing **G=AA'**, **B=CC'** and **W**=**EE'** where **A**, **C** and **E** are lower triangular matrices of (additive) genetic, shared environmental and unique environmental factor loadings, respectively. **A**, **C** and **E** may be estimated by an appropriate algorithm for constrained non-linear optimization (see below) and the estimated genetic and environmental covariance matrices computed as above. The structure of **G, B** and **W** were explored further by factor analysis of their standardized genetic and environmental correlation matrices $\mathbf{R_A}$, $\mathbf{R_C}$, and $\mathbf{R_E}$, respectively.

The full model comprises 3x ½ x 28 x27 =1,134 parameters, estimated from 2 x ½ x 56 x 55=3,080 polychoric correlations, subject to the constraints that the genetic and environmental covariance matrices are at least positive semi-definite and the diagonals of the reproduced phenotypic correlation matrices should be unity.

The large number of variables and model parameters impose constraints on the choice of method for parameter estimation. We estimate parameters by non-iterative least squares applied to estimates of the 56 x 56 matrices of polychoric correlations between responses within and between twin subjects. Correlations were weighted by the total number of twin pairs contributing to each twin sample: MZM, MZF, DZM and DZF. The analysis was conducted separately for same-sex male and female twins. Twin pairs of mixed sex were excluded from the analysis in an attempt to minimize complexity and potential biases that would ensue from having to estimate an even larger number of parameters required to account for cross-sex correlation in the effects of

genes and environment. Previous analyses which included unlike-sex twin pairs found sex differences in the magnitude of the genetic and environmental estimates (Hatemi, Medland and Eaves 2009), further justifying the need for separate analyses by sex.

The matrices of covariance components were constrained to be positive semi-definite by estimating the components of the lower triangular decomposition of each (see above). The model was implemented in Mx with a user supplied loss function for the residual sum of squares. The unit constraint on the diagonals of the reproduced correlation matrix was imposed numerically using Lagrange multipliers. The unit constraints of the total phenotypic correlations for the items were all satisfied to a high degree of precision. Eigenvalues of the estimated genetic and environmental correlation matrices were all positive or zero (Table 1).

(Table 1 about here)

RESULTS

Table 1 gives the eigenvalues of the 28x28 matrices of inter-item correlations for the three sources of variation assumed to underlie individual differences: genes (A); shared environment (C); and unique environment (E). We applied diagonal weighted least squares to polychoric correlation matrices rather than full maximum likelihood because of the prohibitive size of the original matrices and the very large number of model parameters. Furthermore, we chose to estimate the full matrices of genetic and environmental correlations subject only to the constraint that each should be at least positive semi-definite. [i] Comparison of a previous exploration using least squares estimates of attitudes in this sample (Eaves and Hatemi 2008) to maximum likelihood estimates (Hatemi et al 2010) find the two methods produce statistically similar results.

The most striking feature of the table is the very large number of near-zero eigenvalues of

the genetic and shared environmental correlation matrices compared to those of the genetic and within-family, unique, environmental correlations. *The implication is that the effects of genes and common (familial) environment on social attitudes are highly structured and can be represented parsimoniously by a model involving relatively few dimensions. By contrast, the effects of the unique environment are much more item-specific*. Much of the item-specific, unique environmental variance is likely to reflect short term random changes in responses, which also contribute to errors in measurement. Resolution of the short- and long-term effects of the unique environment require repeated measures and is beyond the scope of the current analysis. The dominant eigenvalues of the genetic and shared environmental correlations are large in both sexes and the first three or four dimensions explain a very large proportion of the genetic and shared environmental covariance. The decision about how many factors to retain for rotation is somewhat arbitrary, but examination of the scree plots and factor patterns for all six factor analyses suggested that retention of four factors was justified for all sources in women and three factors in men.

Iterative principal axis factor analysis was conducted for the six correlation matrices, followed by oblique Promax rotation to approximate simple structure. The standardized regressions of the items on the latent genetic and environmental factors are given in Table 2 (women) and Table 3 (men). Inter-factor correlations are shown for both sexes in Table 4.

(Table 2 about here)

Several features of the analysis are noteworthy. First, the communalities of the genetic correlation matrix are almost all close to unity in both sexes. *This suggests that the effects of genes on political attitudes are highly organized, and that attitude development and transmission relies more on common, underlying latent differences in genetic liability than on specific*

*influences that affect attitudes to individual topic*s. Second, the communalities of the shared environmental effects are large, though lower than their genetic counterparts for most items. There is no correlation between the communalities for genes and shared environment in either sex (spearman rank correlation=0.04 in women and 0.00 in men). Furthermore, models which constrained genetic and common environmental factors to be equal resulted in a significant deterioration of model fit ($F_{1567,4780}=2.24$, $P<10^{-6}$, see Web Appendix 3). Thus, although the apparent effects of the shared environment are also organized around common factors, there is support in both sexes for the notion that the shared environment also exercises effects that are more specific to individual items.

(Tables 3 and 4 about here)

The factor loadings in Tables 3 and 4 reveal similarities, and some differences, among the patterns between sexes and between genetic and shared environmental factors within sexes. The similarities may be quantified by computing coefficients of factor similarity (c.f.s., see e.g. Harman, 1975) between the factors (Table 5).

(Table 5 about here)

The coefficients show that each of the three genetic factors in men has clear counterparts in the genetic factor-space of women with c.f.s. of 0.82, 0.74 and 0.82. Some of the genetic information accounted for by the third genetic factor in women is also collapsed onto the first genetic factor in men. There is much weaker congruence between the shared environmental factors across sexes. The c.f.s. for the first shared environmental factor is modest (0.67) and there is some evidence that the second shared environmental factor in males subsumes some of the information in the first female factor. Similarly there is moderate congruence between the second female factor of the shared environment and the first factor in males. *Overall, within*

sexes, there is very little congruence between the structure of the genetic variation and that of the shared environment. Thus, the structure of the underlying genetic effects on social attitudes is not the same as that imposed by differences in the social environment. In addition, certain factors reflected in the shared environment are quite different between men and women.

As far as the patterns of loadings are concerned, the factors of the unique environmental variation are virtually independent and relatively weak. This is in part, because the unique environment subsumes item-specific errors of measurement in cross-sectional twin data. However, both men and women show a first factor that embraces most of the items relating to sex and reproduction: gay rights; abortion; living together; divorce; women's liberation and X-rated movies. The remaining structure of the unique environment is difficult to interpret. There is a very marked "political preference" factor in women comprising positive attitudes to Republicans and negative attitudes to Democrats and vice-versa. This was not replicated in men. The factor relating to attitudes toward sex and reproduction has a strong counterpart in the structure of the shared environment in both sexes, especially in women. The same factor is replicated imperfectly in men. The large loading on "gay rights" is transferred to a factor loading on "moral majority" items, and relative disapproval of reproductive freedom is associated with relatively strong opposition to Republicans, nuclear power and the death penalty.

Women who favor the moral majority and school prayer tend also to support censorship, segregation, socialism and astrology, while being opposed to capitalism, immigration and property tax. Attitudes to the draft and military drill go together in the shared environment, but with somewhat different companion items in the two sexes.

The genetic factor structure is much more clearly defined and shows significant similarities in patterns between men and women. Both sexes show a highly cohesive factor

(factor 4 in women, factor 3 in men) that embraces approval of the moral majority, censorship and school prayer. The same factor loads on opposition to gay rights, divorce, abortion, women's liberation (in men only) and "liberals".

Many of the most salient item loadings on the first genetic factor are consistent across sexes. Thus, in both sexes, an underlying inherited tendency to favor Republicans and oppose Democrats is associated with genetic effects on a cluster of attitudes including opposition to federal housing, busing, unions, socialism, liberals, modern art, pacifism and women's liberation. Furthermore, in males, the same factor extends to include approval of the death penalty, capitalism, military drill, and the draft. In women, the latter items emerge as a partially distinct genetic factor (#3 in Table 2), correlating 0.38 with the first (Table 3) suggesting that the introduction of a fourth genetic factor in women, while possibly justified on the basis of its contribution to variance, sacrifices some of the simplicity of the solution for males that includes only three virtually orthogonal factors.

The most interesting feature of the *genetic factor structure* is the pattern on the *second* genetic factor. Appendix 4 provides a simple summary of the congruence comparing the structure of the second genetic factor and the corresponding social environmental factor (1). Contrary to claims about the patterns of manifest attitudes, the core of items loading on the second genetic factor in both sexes comprise relative *approval* of living together, X-rated movies, divorce, abortion and astrology but, paradoxically, *approval* of the death penalty and segregation and *disapproval* of foreign aid and immigration. In men the same factor incorporates relative *disapproval* of Republicans, federal housing, nuclear power and property tax.

The decision to accept three factors in men and four in women was a matter of judgment based on the principal components of the genetic and environmental correlation matrices. The

solution for women involves four moderately correlated genetic factors. That for men implicates three independent genetic factors. The structure of genetic correlation has marked similarities between the sexes. *The sexes show greater differences in the structure of the "shared environment" and there seems to be relatively weak resemblance, if any, between the structure of the genetic and shared environmental correlations.*

DISCUSSION

The data do not support the simple theory of the "Promethean Genotype" because the role of genetic differences on attitude groupings cannot be ignored. However, neither do the data support any notion that cultural differences merely mirror underlying genetic influences and that "social" anthropology can be forced onto the Procrustean bed of biology. Nor should it be assumed that "genetic" factors reflect long term unchangeable rules of behavior. Patterns of loadings on "genetic" factors only weakly mirror the structure derived from the social milieu and vice versa.

For attitude constructs, it cannot be assumed, therefore, that the effects of genes and the social environment are working in the same direction, or that ideology represents a simple additive effect of genes and environment. Rather, the results imply that ideology is a multidimensional, multi-level process, in which the effects of genes and the social environment impose their own independent shape on observed patterns of political attitudes. In this respect, the effects of the social environment reflect novel patterns of human adaptation superimposed on, and even sometimes acting in opposition to, those introduced by heredity. To be precise, the findings suggest the simple distinction between "conservative" and "liberal" does not capture the complex and divergent nature of genetic and environmental differences in the expression of political attitude constructs and groupings of such constructs. Ideology, at the very least, emerges

as the expression of three distinct levels of influence, with sub elements, and many levels of interaction between them.

Specifically, the large communalities for the items in the "genetic" factor model point to considerable parsimony concerning the influences of genetic liability on the aggregation of attitudes involving a wide range of socially and politically significant topics. *Insofar as genes influence attitudes, their effects are almost entirely generalized over multiple items and show very little item-specificity.* Genes exert their influence in background, foundational ways, not as responses to particular attitude items. Rather than finding support for theories of core "genetic" *individual* political attitudes, we find strong support for genetic sources of attitude *structures*. This is as may be expected, since a flexible, adaptive, efficient, energy saving biological system (i.e., a human) would not be well-served by carrying specific information relevant to a particular time and place across generations or continents. Rather, such a system should only reproduce those broader characteristics, such as a cooperative inclination toward in-group members, or aversion to sexual interlopers, which might be flexibly applied and adapted to a wide variety of circumstances and exert reproductive advantage which varies by time, place, and culture. These inclinations are simply expressed as genetic influences on an attitude, which individually differ in modern populations. This influence travels through a complex latent trait representing numerous cognitive, emotive and dispositional mechanisms. These then appear, when tapped along specifically culturally defined dimensions, as somewhat stable responses within individuals, which may differ over time depending on question and issue framing, and the current interpretation of the attitude.

The pattern of item loadings on the second genetic factor in both sexes implies that the "genetic computation" of individual items differs markedly from those projected by political

elites. Typically scholars, politicians and the media identify a cluster of attitudes that combine opposition to such issues as gay rights and abortion (i.e., "make babies *and* war"). It is also assumed that these positions accompany opposition to logically unrelated topics such as immigration and taxation and relative support for capital punishment and military strength. Together, these attitudes help constitute a "conservative" ideology. However, it seems that genes may "have other ideas". It appears that individuals who are genetically inclined toward attitudes typically considered liberal on matters of sexual behavior and reproduction tend, if anything, toward attitudes understood to be more conservative in relation to a broad range of other issues including the draft, capital punishment, taxation, immigration and segregation.

This underlying divergence in genetic bias may partially explain seemingly irrational or apparently logically ambivalent preferences sets, such as the strong relationship between those who favor the death penalty but simultaneously oppose abortion. It also suggests that those who study electoral outcomes may be missing an important aspect of underlying sentiment that could be used to political advantage to find and create "wedge" issues to realign political constituencies, just as the party of Lincoln did in 1860 with slavery and Ronald Reagan did in 1980 with abortion.

The communalities for shared environmental influences are smaller than those for genetic effects, though many are still very large. This finding points to a high degree of specificity in the social and cultural transmission of attitudes on individual topics. At the level of social influences, attitudes to the death penalty, foreign aid, segregation and immigration cluster on the same factor, and to a large degree match the observed factor structure of attitudes in the extant literature (e.g., Conover and Feldman 1981). Similarly, opposition to abortion, gay rights, living together and divorce load on a separate shared environmental factor positively

correlated with the first. *Thus, unlike the second genetic factor, the structure imposed by social influences corresponds to widely accepted cultural definitions of liberalism and conservatism, in strong support of socialization assumptions of attitude structures.*

However, there is relatively little consistency between the structure of the genetic and shared environmental correlations, suggesting that the influences of genes and environment follow different "rules" and patterns. One possible interpretation of these findings is that the social environment presents an alternative model for adaptive behavior. It is tempting to speculate that the two factors structures correspond in such a manner as to provide a kind of switch between the adaptive demands required by a genetic and evolutionary adaptive strategy to the social requirements enforced by a cultural one. Genetic differences emerge in strategies that focus on success in having offspring, mate guarding and defense of resources, while cultural imperatives emphasize a strategy of adherence to in-group norms, including defense of a particular "way of life" (see MacArthur 1962; Pianka 1970). Neither strategy works in isolation or is absolute in its expression; they are interactive and comingled.

This finding runs contrary to the implied assumptions inferred from the extant literature, that genes and environmental structures are uniform. Upon reflection, this should not prove surprising, given the differences in their origins and functions. That is, the effects of genes and environment on ideological groupings of political attitudes cannot be represented adequately by analyses that focus only on the structure of manifest (expressed) differences. The underlying structure of genetic and environmental influences belies any picture that may be based on phenotypic, or behavioral, differences alone. *Thus, although genetic history and mechanisms may still be expressed across a diverse stream of social values and political behaviors, it appears their effects may not be sufficiently strong to constrain those of the social environment*.

Indeed, we observed the opposite phenomenon; *the pattern imposed by the social environment may, consciously or unconsciously, contradict that previously established by genetic influences*, depending on the time and place. For example, views for or against abortion today based on morality have little to do with those imperatives which existed in past hunter gather societies where conception and infanticide would have been based on factors such as the time of year which might offer optimal prospects for the survival of progeny.

However, certain aspects of the genetic factor structures do resemble elements of liberal-conservative dimensions that are found across cultures, while the social factor structure is much more specific to the elite driven ideologies of the 1980's in the U.S. (when the survey was taken). While the list of items we use is not exhaustive, the implication is clear. *There is not simply a biological component to individual attitudes, but there appears to be a more universal genetic structure of attitudes, and a more specific cultural structure of attitudes, which together combine to be expressed as ideology or liberalism-conservatism, but do not necessarily do so in an additive fashion*. From this perspective, it should not seem especially surprising that a great deal of noise repeatedly appears in existing survey studies which combine political and social attitudes into ideological constructs, or self-described measures of ideology. The consistency and prevalence of this noise may reflect in part the fact that ideology, or attitudes underlying presumed ideological constructs, contains genetic and shared environmental ideologies which have specific attitude structures, in conjunction with salient influences of the day.

Genetically influenced adaptations reflected in certain broad-based political and social attitude groupings might have conveyed meaningful reproductive advantage, for example by helping individuals with similar parenting styles and values meet and mate. Indeed, it remains noteworthy, and we surmise not accidental, that the first factor loading in each sex involved

issues related to sex and reproduction, the very area where we would most expect genetic and biological influences to exert its greatest differences on behavior across generations. The modern environment may present political opportunities and challenges which do not mimic those that created them, but some of the underlying problems remain the same: "How do you treat outsiders?" "How do you create and maintain effective coalitions?" "How do you find and keep a mate?" "How do you provide for your children?" and so on. In this way, environmental and cultural manifestations of particular attitudes and policy questions may vary, but such groupings rest on a long-standing foundation of human behavior which can continue to partially account for divergences in expressed modern day political attitudes.

How might we use this study to help us reconceptualize such differing dynamics and develop a more comprehensive theory of ideology? What implications regarding the source of preference structure can be derived from such findings? While an aggregated methodological grouping may prove ideal for overall factor analysis and offer predictive value for related constructs, it will not necessarily help identify dispositional bases for ideology, or explain why ideologies appear as some mix of both unstable and stable attitudes, or how certain portions of ideology are flexible, while others seem persistent and uniform across cultures. In the single construct of ideology, divergent influences exist underneath the measured trait. Based on the findings here, separating and exploring individual items and combining those into different factor structures according to their source (genes, social, unique environment) offers a method to better clarify the precise ways in which genes and environment interact to influence ideology and offer novel pathways to identify preference structures.

Indeed, the differences found here imply that the structure imposed on social and political attitudes by the social environment is a cultural veneer laid on a potentially *unrelated* underlying

structure of genetic differences. This would make sense within the context of an adaptive human mind operating across myriad locales and generations. For example, emotional experience and expression appears near universal in healthy individuals; however, people tend to experience fear or anger in response to different situations and conditions. In this way, the psychological mechanism undergirding a particular emotional system can be universal, but the environmental conditions which precipitate its expression may differ across individuals. Here we suggest that having an ideology may represent one of those universal psychological mechanisms designed by natural selection to allow individuals to optimize cognitive and emotional resources to better function across time and space but remains contingent and adaptive depending on context, social influences, situational constraints and incentive structures.

Our study adds a new dimension to the theoretical conception of ideology, and with regard to attitude groupings, provides evidence of a much more complex process by which it is acquired and maintained. The findings suggest that items that group together phenotypically will not necessarily group together genetically, and these groupings may indeed, at certain times in history or the future, change in their relationship to one another. In our current climate, it appears that in many ways biology and culture provide divergent influences on one's ideological makeup. Genetic influences would be expected to reflect broadly based, flexible, longstanding patterns of adaptation which proved advantageous for resolving repeated problems over time. Cultural influences should respond to more immediate, narrow and specific concerns related to challenges which emerge in specific time periods and locations, and may run contrary to underlying biological imperatives for a whole host of locally generated reasons. That is, the modern instantiation of specific attitudes may be quite different from those reflected in the past. For example, the benefits to survival offered by polygyny in the past, including greater prospects

for the survival of orphaned children, would not necessarily accrue in the same way to children born today, and attitudes toward its existence would come to be informed by different sets of underlying values in the modern world, for example those involving equity. In this way, socialized values can influence the expression and manifestation of universal propensities, such as the experience of parenting. Yet these shifting values do not appear to restrict the basic human reproductive drive overall. Environmental contingencies may render some experiences more common or adaptive at certain times or in particular locales, but that does not mean that underlying mechanisms diminish. Rather, the potential for various expressions of the same basic drives exist and can manifest differently in diverse populations or in divergent areas or during different time periods.

Nonetheless, our findings do not entirely contradict the existing theoretical approaches to ideology. Only, the implied assumption of a uniform structure was not supported. However, none of these approaches is complete in isolation, because, as noted, we find a strong genetic factor structure of attitudes that is remarkably different from that of the social environment. Thus, rather than replacing existing social environment and rational actor models, incorporating the biological element into them, and recognizing that multiple layers of ideology exits, will likely produce a more comprehensive and accurate model of ideology.

In light of these findings, we suggest a re-definition and integration of theories of ideology, where ideology represents more than the sum of expressed attitudes and opinions mapped onto elite discourse based on the social context of the day. Rather, if we hope to understand and categorize ideology on the individual level as well as within the mass publics, we must incorporate the multidimensional and multilevel process of ideology that comes from the combination of biology, social upbringing and life experience.

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Table 1: Eigenvalues (λ) of genetic and environmental correlations for 28 attitude items in males and females.

#	λ					
	Women			Men		
	A	C	E	A	C	E
Death penalty (-)	9.89	8.11	3.61	12.38	10.02	4.30
Astrology	6.51	5.69	2.38	7.13	4.04	2.83
X-rated movies	3.51	3.69	1.85	5.42	3.44	2.13
Modern art	3.09	2.76	1.80	1.50	2.34	1.50
Women's liberation	1.17	1.49	1.42	0.52	1.64	1.39
Foreign aid	0.96	1.27	1.26	0.40	1.47	1.29
Federal housing	0.62	1.05	1.14	0.27	1.06	1.20
Democrats	0.56	1.02	1.07	0.13	0.94	1.04
Military drill (-)	0.52	0.80	0.99	0.08	0.65	1.01
The draft (-)	0.35	0.73	0.99	0.06	0.48	0.99
Abortion	0.22	0.58	0.94	0.04	0.32	0.95
Property tax	0.21	0.36	0.88	0.04	0.31	0.88
Gay rights	0.15	0.29	0.86	0.02	0.20	0.82
Liberals	0.11	0.18	0.84	0.01	0.20	0.76
Immigration	0.06	0.00	0.80	0.00	0.03	0.74
Capitalism	0.04	0.00	0.74	0.00	0.02	0.72
Segregation (-)	0.03	0.00	0.73	0.00	0.01	0.69
Moral majority (-)	0.00	0.00	0.69	0.00	0.00	0.62
Pacifism	0.00	0.00	0.66	0.00	0.00	0.58
Censorship (-)	0.00	0.00	0.63	0.00	0.00	0.53
Nuclear power (-)	0.00	0.00	0.60	0.00	0.00	0.53
Living together	0.00	0.00	0.57	0.00	0.00	0.47
Republicans (-)	0.00	0.00	0.54	0.00	0.00	0.42
Divorce	0.00	0.00	0.51	0.00	0.00	0.39
School prayer (-)	0.00	0.00	0.45	0.00	0.00	0.38
Unions	0.00	0.00	0.40	0.00	0.00	0,34
Socialism	0.00	0.00	0.36	0.00	0.00	0.27
Busing	0.00	0.00	0.00	0.00	0.00	0.00

Notes: A is Additive Genetic; C is Common or Shared Environment; E is Unique Environment

Table 2: Factor analyses of genetic and environmental correlational structure for 28 social attitudes in women.

Item		Genetic					Shared environment					Unique environment				
Q.	Content	1	2	3	4	h^2	1	2	3	4	h^2	1	2	3	4	h^2
7	Federal housing	**91**	09	-25	-18	92	-04	47	-04	-18	28	04	**-40**	23	02	22
28	Busing	**85**	-16	27	-04	83	-15	-27	**53**	-30	40	08	-05	07	-30	13
8	Democrats	**83**	13	-38	14	89	27	-05	-13	**88**	75	-01	-20	**67**	00	48
26	Unions	**79**	**55**	-04	-24	64	**56**	-23	01	43	47	-01	13	31	-19	18
27	Socialism	**69**	-22	23	22	73	48	**-64**	33	06	76	12	11	21	**-41**	26
14	Liberals	**65**	01	-26	**64**	91	**89**	24	12	22	93	**48**	-06	29	-11	46
4	Modern art	**65**	04	**54**	-05	70	**84**	-11	-13	04	68	23	-15	05	-09	13
23	Republicans (-)	**61**	-11	24	-02	45	-09	-04	04	**90**	87	-16	13	**63**	14	41
19	Pacifism	**59**	47	35	24	70	31	-44	**53**	-32	65	10	14	09	**-43**	22
5	Women's liberation	**58**	-02	**51**	27	79	**76**	28	-30	02	77	**43**	-11	08	-03	25
1	Death penalty (-)	21	**87**	39	-12	71	-26	29	**57**	21	50	-07	13	32	01	12
6	Foreign aid	23	**80**	-17	00	83	40	08	06	**-68**	71	01	**-43**	03	-02	19
17	Segregation (-)	-25	**78**	22	35	61	-09	**76**	-05	-27	69	-04	-12	07	**42**	18
15	Immigration	16	**70**	-34	12	78	26	**60**	13	-41	69	03	-39	12	00	18
16	Capitalism	-22	**66**	-35	**60**	84	23	**63**	-29	-24	75	08	-24	-11	04	08
22	Living together	17	**-56**	31	47	97	**88**	-20	-06	-10	78	**67**	08	-17	-02	39
3	X-rated movies	-01	**-65**	23	23	72	**89**	-48	06	-07	93	**40**	10	-07	-02	14
24	Divorce	07	**-67**	-06	**52**	81	**59**	06	**-61**	-09	73	**54**	-09	-18	03	29
11	Abortion	06	**-79**	-17	**52**	93	**71**	28	-17	-14	71	**60**	-06	-13	07	34
2	Astrology	05	**-81**	-01	16	72	28	**-66**	-10	00	45	11	01	00	-22	06
9	Military drill (-)	-01	12	**94**	-01	81	15	47	**78**	-05	78	06	**55**	08	02	31
10	The draft (-)	18	21	**89**	26	91	00	00	**80**	-09	62	03	**60**	-13	-08	36
21	Nuclear power (-)	21	-11	**85**	-05	82	-08	-21	**51**	24	46	-06	27	32	04	17
12	Property tax	20	05	**-92**	-04	93	-19	**83**	-09	-21	79	07	32	-06	00	12
13	Gay rights	36	00	-15	**77**	76	**80**	40	16	-03	92	**70**	-01	14	06	56
18	Moral majority (-)	-26	-03	33	**71**	75	18	**88**	14	29	89	14	09	15	**48**	26
20	Censorship (-)	**-52**	-06	24	**70**	82	23	**59**	03	19	44	10	13	12	**40**	20
25	School prayer (-)	13	-15	39	**68**	88	37	**69**	19	10	69	10	11	13	25	09

Note: Loadings >|0.5| in bold type for A and C; Loadings >|0.4| in bold type for E. Iterative principal axis factors of genetic and environmental correlations followed by Promax rotation to oblique simple structure. h^2 denotes communality (not heritability) Generally positive loadings imply disagreement. Positive loadings on reflected items, labeled (-) in the table, imply agreement. All values represent hundredths.

Table 3: Factor analyses of genetic and environmental correlational structure for 28 social attitudes in men.

Item		Genetic				Shared environment				Unique environment			
Q.	Content	1	2	3	h^2	1	2	3	h^2	1	2	3	h^2
7	Federal housing	**55**	**87**	-12	91	**81**	-01	-40	73	07	38	-22	21
28	Busing	**92**	06	-24	94	09	**52**	-38	35	04	37	-03	14
8	Democrats	**60**	-46	16	67	**84**	-48	-19	77	-09	**71**	03	47
26	Unions	**75**	-05	-17	64	39	11	-49	29	08	36	-12	16
27	Socialism	**89**	-29	-04	98	-04	**57**	17	39	13	33	-07	15
14	Liberals	**85**	-14	**56**	97	**87**	21	-02	89	28	**49**	04	40
4	Modern art	**77**	03	-32	76	44	35	**57**	88	33	07	-01	13
23	Republicans (-)	**62**	**-52**	20	79	30	**-56**	-43	58	-33	35	**47**	41
19	Pacifism	**77**	-33	-05	81	**74**	03	06	58	-01	**43**	-13	19
5	Women's liberation	**63**	11	**71**	77	**68**	34	-19	66	**42**	27	05	33
1	Death penalty (-)	**87**	**66**	23	96	14	**-85**	35	69	-12	**48**	23	28
6	Foreign aid	09	**100**	-11	98	**73**	12	12	63	13	33	-33	25
17	Segregation (-)	-13	**86**	-41	97	42	-06	04	17	03	-06	25	06
15	Immigration	-18	**92**	04	94	**94**	-16	-13	83	07	39	-26	23
16	Capitalism	**-53**	**64**	29	95	**63**	04	07	42	25	02	-26	13
22	Living together	12	**-82**	49	97	44	**53**	31	79	**67**	-05	17	45
3	X-rated movies	17	**-83**	35	89	29	**60**	45	88	**50**	-05	03	24
24	Divorce	-39	-42	**79**	97	20	**77**	-18	68	**51**	11	-11	31
11	Abortion	-37	-39	**82**	98	49	**70**	-16	85	**59**	-02	06	34
2	Astrology	29	**-75**	-38	92	-26	**54**	03	30	22	04	-08	06
9	Military drill (-)	**71**	01	27	53	21	-27	**86**	77	-04	-07	**57**	33
10	The draft (-)	**80**	-15	-01	71	18	03	**69**	55	-02	-05	**56**	31
21	Nuclear power (-)	**68**	**-56**	-10	95	07	**-84**	-03	69	-25	08	35	18
12	Property tax	-33	**82**	13	92	48	-12	**-50**	43	23	15	-21	14
13	Gay rights	26	07	**97**	95	**95**	01	04	92	**50**	**40**	20	56
18	Moral majority (-)	-08	00	**93**	90	**76**	-31	30	66	20	-13	**45**	23
20	Censorship (-)	-34	16	**83**	92	**51**	-07	48	53	14	-22	**42**	22
25	School prayer (-)	32	19	**96**	96	48	10	25	37	21	03	**46**	26

Note: Loadings >|0.5| in bold type for A and C; Loadings >|0.4| in bold type for E. Iterative principal axis factors of genetic and environmental correlations followed by Promax rotation to oblique simple structure. h^2 denotes communality (not heritability). Generally positive loadings imply disagreement. Positive loadings on reflected items, labeled (-) in the table, imply agreement. All values represent hundredths.

Table 4: Correlations between genetic and environmental factors of social attitudes in men and women.

		Correlation between factor (Promax)						
		Women				Men		
Source	Factor	1	2	3	4	1	2	3
Genes	1	1.00	0.36	0.38	0.16	1.00	0.08	-0.01
	2		1.00	0.25	0.36		1.00	0.06
	3			1.00	0.13			1.00
Shared Environment	1	1.00	0.35	0.25	0.09	1.00	0.25	0.14
	2		1.00	0.13	-0.13		1.00	0.22
	3			1.00	-0.01			1.00
Unique Environment	1	1.00	0.22	0.11	0.02	1.00	0.29	-0.01
	2		1.00	0.04	-0.09		1.00	0.06
	3			1.00	0.30			1.00

Table 5. Coefficients of similarity between genetic and shared environmental factors.

		Male genetic			Female shared environment			
	Factor	1	2	3	1	2	3	4
Female Genetic	1	**0.82**	-0.05	0.05	0.46	-0.15	0.25	0.22
	2	0.14	**0.74**	-0.25	-0.24	0.38	0.28	-0.16
	3	**0.56**	-0.31	0.12	0.17	-0.12	0.62	0.12
	4	0.06	-0.09	**0.82**	**0.67**	0.46	0.01	-0.00
Males shared environmental	1	0.37	0.27	**0.58**	**0.67**	**0.55**	0.13	-0.01
	2	-0.07	-0.28	0.16	**0.57**	-0.28	-0.34	-0.41
	3	0.18	-0.12	0.20	0.23	0.06	0.46	-0.11

Note: Coefficients are the standardized product moments around the origin (zero) of the factor loadings. Coefficients greater the 0.5 in bold type.

[i] These components gave a close fit to the observed correlations by the criterion of mean square error; however we made no attempt to simplify the structure apart from factor analysis of the genetic and environmental correlation matrices.