Genetics, Personality, and Group Identity*

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Objective. Group identity is a central concept in many social science disciplines. We investigate why people identify with groups and show favoritism to in-group members. We anticipate group identifications are substantially influenced by genes and social environments, likely working through stable personality traits. *Methods.* Using twin study data from the National Survey of Midlife Development in the United States (MIDUS I), we investigate the heritability of in-group identification and favoritism, as well as the extent to which the genetic bases of these orientations are shared with genetic underpinnings of personality traits, primarily focusing on the "Big Five": openness to experience, conscientiousness, extraversion, agreeableness, and emotional stability/neuroticism. *Results.* Group identification is largely attributable to genetic factors. However, environments also affect group identification. The heritability of personality traits accounts for a modest portion of the genetic variation of group identification. *Conclusion.* Our findings have implications for the study of collective action, identity politics, and the growing research program investigating social and political behavior genetics.

Social identity is a well-studied aspect of social and political psychology because of its broad implications for individuals and groups. These identities, often formed around descriptive and demographic characteristics like race, religion, and gender, can powerfully link people to each other. Even episodic identities formed around minimal groups[1] can provide people with a source of self-esteem, promote solutions to collective action problems, and inform norms as well as enforcement mechanisms for them. More culturally embedded group identities may also provide rationales for exclusion, prejudice, conflict, and collective violence.

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[1] A classic and extensively replicated example of this assigns people to groups of "overestimators" and "underestimators" at random (Tajfel and Turner, 1979).

SOCIAL SCIENCE QUARTERLY, Volume 92, Number 5, December 2011

DOI: 10.1111/j.1540-6237.2011.00820.x

Why do people develop group-based identities and display in-group favoritism? In the 20th century, pluralists such as Truman (1951) asserted strongly that internal pressure to identify with groups was innate. Others, including social capital (Putnam, 2000) and rational choice theorists (Olson, 1965), reject this notion. In the eyes of the former, group identifications are another element written on the *tabula rasa* of the human mind through socialization. To the latter, associations are born of common interests and incentives. Although groups and group membership are quite well studied, the notion that group identities may be a fundamental aspect of human nature, and thus partially influenced by genetics, has seen little empirical investigation (but see Lewis and Bates, 2010).[2] We take seriously the idea that people have an innate drive to associate with others and investigate the extent to which the impetus to associate with groups is heritable.

We extend research on the heritability of in-group orientations (Lewis and Bates, 2010; Hatemi et al., 2009) to investigate their shared genetic covariation with personality. We also join social scientists who have become increasingly interested in the role personality plays in connecting genetic variation and political and social phenotypes (e.g., Mondak et al., 2010; Verhulst, Hatemi, and Martin, 2010) by considering the extent to which personality and racial, ethnic, and religious identifications share similar genetic etiology. We have specific reasons to consider the genetic relationship between personality and group orientations because researchers find that observed personality traits and group orientations are associated. In a wide-ranging meta-analysis, Sibley and Duckitt (2008) find that conscientiousness and emotional stability (two major personality traits) are strong predictors of social dominance orientation. We contribute to this research as well, finding evidence of genetic covariation between personality and group orientations, particularly religious identity.

To examine the heritability of in-group attachments, we use data from adult twin participants in the National Survey of Midlife Development in the United States (Brim et al., 1995–1996). This survey included measures of attachment to ethnic, racial, and religious groups. We begin by exploring the theoretical reasons why we expect attraction to groups to have a partial biological basis and the potential role personality plays linking genes and group identification. Much of this theory comes from research conducted in social and evolutionary psychology. Next we describe how the classic twin study design allows us to estimate the heritability of group attachments. We conclude with a discussion of theoretical implications and paths for future research.

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[2] Others have investigated the heritability of social and psychological phenomena *related* to group affiliation, including social trust (Sturgis et al., 2010), religiosity (Eaves et al., 2008), and political partisanship (Settle, Dawes, and Fowler, 2009). These studies consistently identify a partial degree of heritability for each of these characteristics.

Social Identity, In-Group Favoritism, and Group Membership

Most students of politics, psychology, and sociology are well aware of assertions of human sociability. These insights come from a collection of theorists and empirical scholars across time and academic discipline, not limited to Aristotle, Baruch de Spinoza, Arthur Bentley, and Elliot Aronson. For example, Truman asserts: "with rare exception man is always found in association with other men" (1951:14). Groups structure the social world. The social groups to which people belong give them a reference point, allowing them to navigate complicated issues (Berelson, Lazarsfeld, and McPhee, 1954). Many people attribute attitudes to individuals on the basis of their group memberships (Brady and Sniderman, 1985).

Psychologists have long noted the centrality of group identification in human behavior. In the seminal Robbers Cave experiment (Sherif, 1966), preteen boys drawn from the same ethnic and social backgrounds were randomly assigned to groups and subsequently competed for finite resources. Although assignment was random, each group developed intense in-group identification and suspicion of the other group. Organized intergroup competition exacerbated the intensity of group identification and corresponding level of in-group bias expressed by the boys in the form of aggressive behaviors toward the other group (Sherif, 1966). Subsequent research has shown that a strong drive to display favoritism toward groups with which one identifies (i.e., in-group bias) is not simply confined to children or contexts that feature intense intergroup competition (Moghaddam and Taylor, 1994). Indeed, group identities often form easily with minimal information and even along arbitrary axes created in laboratory settings, and group members strive to maintain these identities (Brewer, 2007; Tajfel and Turner, 1979). Groups exert a powerful influence on an array of attitudes and behavior, and the characteristics used to define social groups are often arbitrary but may be cultural (Sidanius and Pratto, 2001).

Behavioral economists also find that identity affects collective action and norm enforcement. Kollock (1998) shows that members of social organizations (e.g., college fraternities) are more likely to cooperate with in-group members in prisoner's dilemma games. In addition to the creation of out-group distrust, groups constructed at random can generate strong patterns of in-group affiliation. Goette, Huffman, and Meier (2006) similarly demonstrate that military officer candidates assigned to platoons at random develop social ties and more cooperation with fellow group members. They also enforce a norm of cooperative behavior within groups.

Several psychological theories have been developed to explain human beings' penchant for group identification. Given the breadth of this literature, we cannot cover all these theories and their nuances; instead, we confine ourselves to highlighting overarching themes. Social identity theory identifies a universal need for self-esteem as a motivating principle. People gain self-esteem by identifying with viewing their group positively relative to other groups. Work has also shown that individuals identify more strongly with their in-group in situations of pervasive threat to enhance individual well-being (Pyszczynski, Solomon, and Greenberg, 2003).[3] Central to these diverse theoretical frameworks is the notion that group identification is the outgrowth of psychological needs. Scholars who draw on evolutionary models of human behavior contend that these internal drives may have formed as adaptive solutions to dilemmas faced by early humans. It is this work, which we discuss next, that articulates why we should observe individual-level variance in the intensity with which people develop group identities and, in doing so, provides a rationale for why group identification may have a genetic basis.

Optimal Distinctiveness: Variation in Identification and Individuation

Groups play a strong role in structuring identities and have implications for association, collective action, and sociability within and competition outside the group; however, individuals vary in the extent to which they experience these attachments. People vary in their sense of belonging to and identification with groups. In addition to their need to belong (Baumeister and Leary, 1995), people also experience a strong need to be unique individuals (Brewer, 2007). People seek uniqueness and not simply affiliation, searching for a balance of distinctiveness from and similarity to others (Snyder and Fromkin, 1980).

This search for "optimal distinctiveness" (Brewer, 2007) causes humans to categorize the world into in-groups and out-groups—often based on arbitrary characteristics such as race and religion. Social trust is extended to in-group coalitional partners who are expected to embrace and follow group-shared norms of conduct, while wariness is accorded to out-group members who may not.[4] As such, evolutionary theories regard self-esteem and the ability to cope with existential anxiety as byproducts of in-group bias.

In considering the universal drive to form group identities, it is important to note that social identities vary in several ways. Identity scholars have shown it is important to consider the degree to which social identities are fixed versus malleable. Huddy (2001) demonstrates the importance of considering identity strength, whether one is born into a group, and the permeability of group membership. In a meta-analysis of social identity articles, Munley et al. (2002) develop a typology of identity classification by differentiating among fixed identities, identities that have low exit costs, and identities that are defined by national boundaries imbued with historical significance. In line

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[3] Social identity theory and social categorization theory specify somewhat different psychological processes, but both place the motivation for positive differentiation at the center of their model.

[4] The extent to which out-groups are distrusted and, therefore, subject to derogation by in-groups depends on a number of factors—including perceived threat posed by the out-group to the status of the in-group in the social hierarchy, distinctiveness of the in-group, and survival of in-group members (e.g., Brewer, 2007).

with this literature, we explore the heritability of three identity processes that roughly map onto this typology—racial, religious, and ethnic identification.

Therefore, research on identity and groups does not suggest everyone should possess the same intensity in the drive to identify with social groups. The transmission of genes from parents to offspring involves some stochastic element, which means we should observe variance in all heritable traits (Tooby and Cosmides, 1992). Moreover, if humans have competing drives toward general sociability on the one hand, and the need for acceptance by an inclusive group on the other, as Brewer (2007) describes, some people have a higher need to belong, while others have a higher need to be sociable. While elements of self-categorization are influenced by context, people exhibit stable individual differences in their readiness to self-categorize in group or individual terms (Nario-Redmond et al., 2004). Thus, the process of reconciling group attraction and the need for distinctiveness should produce individual differences in group identification, partially heritable and influenced by environmental factors.

Heritability of Group Identity

Students of behavior genetics using the classic twin design (e.g., Medland and Hatemi, 2009) usually decompose the variation of a characteristic, or phenotype, into three major sources: additive genetics, the cumulative effects of heredity; the common environment, that is, influence of families and culture; and unique environments experienced by individuals. Lewis and Bates (2010) find that the variance in group identification and favoritism is explained by genetic factors. The remaining variation is associated with the unique environment. The common environment—family socialization and culture—appear to have little influence on these attitudes.

We should note that this does not suggest that identification with a particular group is beneficial. Indeed, the selection and preference of one group over another is often arbitrary, based on characteristics such as skin color, sex, religion, and physical stature. Sidanius and Pratto (2001) suggest that while sex and age groups emerge in nearly all societies, "arbitrary set" groups are pervasive across cultures and are the root cause of much group-based animus. As such, it is important to emphasize that *group identification is generic in the sense that it applies to many social groups*. In fact, Lewis and Bates (2010) demonstrate that a large portion of racial, ethnic, and religious identification is influenced by a common affiliation mechanism (CAM)—a general tendency to associate beyond attachments defined by specific, essentialist identities.

Personality and the Heritable Basis of Group Identification

We anticipate that the mechanism connecting genetic factors or biochemical processes to social attitudes and behavior is not direct. We do not anticipate the existence of an "in-group gene," for example. Rather, we expect these biological factors to affect other psychological orientations, developed as adaptive strategies over the course of human evolution, and to interact with environmental factors to influence group judgments. Mondak et al. present such a model (2010:88, Figure 1), anticipating that genes and other biological factors influence personality, which then influences social and political behavior.[5]

In modern societies, people navigate social and political environments that look quite different from the ones in which human ancestors lived. Nonetheless, today's political and social attitudes may either reflect adaptations fashioned during the Pleistocene Age or byproducts of those adaptations (Tooby and Cosmides, 1992). In our model, we highlight in broad strokes one possible pathway through which human biology may affect distal phenotypes such as in-group attitudes. Genes, which are a function of natural selection and stochastic variation, influence the physical architecture of the brain, which houses the "mind." The mind is "a crowded zoo of evolved, domain specific programs" (Cosmides and Tooby, 2004:91). Each of these programs was selected as a solution to a particular adaptive dilemma, such as mate selection or the need to navigate a complex social environment. We use personality traits as a starting point because these dispositions arose early during human evolution as adaptive strategies to deal with fluid social environments. As Buss and Greiling (1999) argue, some personality traits are more or less successful depending on the context. In some situations, for example, aggressiveness is rewarded, whereas in others it is punished. Individual differences in personalities reflect alternative strategies to cope with the social environment. Because personality traits emerge early in the course of an individual's development and are a function of genetics and environmental influences (Bouchard and McGue, 2003; Buss and Greiling, 1999), we surmise that they may function as one of the lenses through which individuals sort and evaluate extemporaneous information, and thereby guide the development of political and social attitudes. Our surmise is supported by empirical evidence that personality traits and political attitudes "share a common genetic basis" (Eaves and Eysenck, 1974:288), but we also appreciate that as a starting point we are necessarily oversimplifying the true connection between genes, personality dispositions, and in-group identities (see Verhulst, Hatemi, and Martin, 2010).

Social scientists have an enduring and growing interest in personality. Political science in particular is enjoying a resurgence of interest in personality (e.g., Mondak and Halperin, 2008). Recent work demonstrates that personality traits directly and indirectly influence political attitudes (Gerber et al., 2010; Mondak and Halperin, 2008; Sibley and Duckitt, 2008), identities (Gerber et al., forthcoming), and behavior (Mondak et al., 2010; Vecchione and Caprara, 2009).

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[5] The Mondak et al. model is inevitably incomplete. Others, including Smith et al. (2011) and Verhulst, Hatemi, and Martin (2010), present useful alternatives. However, each of these center largely on the shared idea that social and political judgments and personality traits are both affected by genes and environments and are related to each other to some extent.

Much of this political science and social psychology research relies on the Five-Factor Model of Personality, or the "Big Five." The model refers to five enduring clusters of personality traits identified by decades of personality studies (John, Naumann, and Soto, 2008): openness to experience, agreeableness, extraversion, emotional stability, and conscientiousness. Although these five factors do not account for all the variance in personality differences (e.g., Verhulst, Hatemi, and Martin, 2010), they do represent "broad domains" that "collectively organiz[e] and summariz[e] the vast majority of subsidiary traits" (Mondak et al., 2010:86). While other organizational typologies exist, the Big Five has been central to personality research over the past 20 years (John, Naumann, and Soto, 2008).

We focus on how variation in human genetics accounts for variation in in-group identities through genetically induced variation in personality traits. We expect that the heritability of in-group identities works through the Big Five personality traits.

- ***Openness to experience*** describes individuals' cognitive orientation to the external world. Individuals high on this factor tend to be attracted to new modes of thinking, while those who are low on it develop more rigid worldviews. It, along with extraversion and agreeableness, correlate with partisan identities in the United States (Gerber et al., forthcoming). Consequently, openness may effect the degree to which people expose themselves to individuals from different groups and thereby influence the intensity with which people develop identities to long-standing social groups.
- ***Agreeableness*** refers to how individuals interact with others. It is associated with conflict orientations (e.g., attraction or aversion), altruism, and trust (McCrae and Costa, 1996). Because social groups are, in part, an adaptive response to dilemmas faced by human ancestors centered on decisions to trust others (e.g., Brewer, 2007), agreeableness may also affect the degree to which people rely on social groups to navigate their social environment and, therefore, the intensity of in-group identities.
- ***Extraversion*** describes the degree to which people draw energy from social situations, and may influence how central social groups are to their lives. This trait predicts how people navigate and the extent to which they rely on social networks (Lieberman and Rosenthal, 2001) and, as such, may indirectly influence how much people identify with the groups embedded in their social networks.
- ***Emotional stability/neuroticism*** refers to individuals' level of emotional adjustment. Those high on the factor tend to express stable emotionality and those low on the factor have more anxiety. Emotional stability predicts status in a social group (Anderson et al., 2001), which may in turn influence the intensity with which people form in-group identities.
- ***Conscientiousness*** describes impulse control and orderliness. Individuals who score high on this factor tend to be organized, norm following, and

reliable, whereas those who score low tend to be unorganized, impulsive, and unreliable. We suspect this personality trait may influence the degree to which people rely on group identities to structure their personal lives.

We focus on these personality traits because there is mixed evidence that the phenotypic variation of these may be connected to how people reason about groups. Most of this research is focused on out-group attitudes. Sibley and Duckitt (2008) examine a variety of studies associating the Big-Five personality factors with prejudice, as well as with social dominance orientation and right-wing authoritarianism. Openness to experience and agreeableness are most strongly associated with prejudice (see also Ekehammar and Akarami, 2003). Saucier and Goldberg (1998) find correlations between prejudice and emotional stability as well.

Expectations

We begin by replicating, in part, research on the heritability of in-group favoritism and identity (Lewis and Bates, 2010) and extend this to consider the role personality plays. Because there is a documented empirical association of personality factors with group orientations, and because personality plays a theoretical role mediating genetic influences on social and political attitudes, we anticipate the heritability of in-group favoritism and identity (i.e., the observable aspects of group orientations) will be shared with personality characteristics. Consequently, we investigate the extent to which a common set of genetic factors gives rise to personality traits and group attachments. We expect to find that these in-group judgments substantially share their genetic basis with personality traits.

Methods

To test these expectations, we rely on the National Survey of Midlife Development in the United States (MIDUS) data from 1995–1996. The main sample consisted of over 7,000 adults, though the subsample we analyze is from from MIDUS "Twin Screening Project." Specifically, identical or monozygotic (MZ) and fraternal or dizygotic (DZ) twin pairs were interviewed, as well as nontwin siblings. In the MIDUS data, we identified 691 same-sex twin pairs ($n = 1{,}382$): 349 MZ pairs and 342 DZ pairs.

The classic twin design offers a powerful method for estimating the heritability of phenotypic traits (see Medland and Hatemi, 2009; Neale and Cardon, 1992). It is possible to derive estimates of phenotypic variation explained by heritability, since MZ and DZ twins raised in similar environments (e.g., they share the same age, attended school at the same time, were raised in the same household environment), yet MZ twins share 100 percent of their genes while DZ twins share, on average, 50 percent of their genes. By holding the common environment constant and varying the genetic differences, one can estimate the proportion of the variation in an expressed phenotype attributable to genes (Plomin et al., 2001; Neale and Cardon, 1992). This is accomplished by comparing the covariances for MZ twins to those for DZ twins.

A central assumption in twin research is that since MZ and DZ twins tend to be reared together, they share equal postnatal environments. This is the *equal environments assumption*. Making this assumption allows one to directly compare the correlation between MZ twins to DZ twins. If MZ twins are more similar, we assume this is due to their greater genetic similarity. Heritability is the proportion of the variance in the expression of a trait due to *all* genetic factors. This is often referred to as *A* in twins research, or the "additive genetic influence" (Plomin et al., 2001). The variation not due to heritability can subsequently be decomposed into variance due to the common environment (C)—that is, variance shared by each individual in the twin pair—and environmental variance unique to each twin (E). Like others (Medland and Hatemi, 2009; Posthuma, 2009), we estimate these three "variance components" using structural equation models.

Using these pairs, we focus on nine questions pertaining to group identification. Three types of group identification are explored. RACIAL IDENTIFICATION was measured from three items: "How closely do you identify with your racial group?" coded from 1 (very closely) to 4 (not at all closely); "How much do you prefer your racial group?" coded from 1 (a lot) to 4 (rarely); "How important is it to marry within your racial group?" coded from 1 (very important) to 4 (not at all important). ETHNIC IDENTIFICATION and RELIGIOUS IDENTIFICATION were measured with the same battery of questions, with "ethnic" and "religious" replacing "race" in the above questions.[6] All variables were recoded from 1 to 4, where high scores denote stronger group attachment.

In addition to analyzing these items individually, we constructed composite scales for racial, ethnic, and religious identification. "Identity strength" factor scores were generated from a three-factor model (using the race, ethnic, and religious items as indicators). For instance, racial identification, racial preference, and racial marriage were specified to load on the race factor. Because the indicators are categorical, the items were specified to relate to the factors with an ordered probit link. For identification, the factor variances were set to 1 and the loadings were freely estimated. We also allowed covariances to be estimated between the factors, since the identity variables are correlated. The factor model was estimated using maximum likelihood in M*plus* version 6.11 (Muthén and Muthén, 1998–2007).[7] Descriptive statistics and correlations are presented in Table 1. As anticipated, we see substantial individual variation across these items. For the nine individual items, on average, the MZ twins

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[6] For all the religious identification questions, the response options range from 1 (very) to 4 (not at all).

[7] On the whole, the racial, ethnic, and religious items were internally consistent ($\alpha_{race} = 0.71$; $\alpha_{ethnic} = 0.78$; $\alpha_{religion} = 0.83$).

TABLE 1

Descriptive Statistics for the MIDUS Data

	YMZ (*SD*)		*YDZ*(*SD*)		*p* Value	*rMZs*	*rDZs*
Racial identification	3.27	(0.96)	3.20	(1.02)	0.23	0.28 [0.14, 0.41]	0.08 [–0.08, 0.24]
Racial preference	2.78	(1.03)	2.74	(1.05)	0.46	0.37 [0.25, 0.49]	0.26 [0.12, 0.40]
Racial marriage	2.69	(1.10)	2.78	(1.09)	0.12	0.55 [0.45, 0.65]	0.31 [0.19, 0.43]
Ethnic identification	2.27	(1.00)	2.38	(0.98)	0.09	0.41 [0.28, 0.55]	0.19 [0.03, 0.34]
Ethnic preference	1.87	(0.97)	1.95	(1.04)	0.36	0.47 [0.35, 0.59]	0.23 [0.05, 0.41]
Ethnic marriage	1.73	(0.91)	1.75	(0.94)	0.98	0.38 [0.22, 0.54]	0.37 [0.21, 0.53]
Religious identification	2.76	(1.05)	2.85	(0.99)	0.17	0.62 [0.52, 0.72]	0.41 [0.29, 0.53]
Religious preference	2.41	(1.04)	2.43	(1.00)	0.76	0.52 [0.42, 0.62]	0.33 [0.21, 0.45]
Religious marriage	2.21	(1.11)	2.31	(1.09)	0.07	0.57 [0.47, 0.67]	0.41 [0.29, 0.53]
Identity strength (race)	0.00	(0.04)	0.04	(0.03)	0.96	0.43 [0.34, 0.52]	0.27 [0.16, 0.37]
Identity strength (ethnicity)	–0.04	(0.03)	0.04	(0.03)	0.11	0.43 [0.33, 0.51]	0.20 [0.09, 0.31]
Identity strength (religion)	–0.03	(0.04)	0.04	(0.03)	0.18	0.56 [0.48, 0.64]	0.39 [0.28, 0.48]

All variables are coded from 1 to 4, where high scores denote greater identification. The identity strength variables are factor scores derived from a confirmatory factor model where identification, marriage, and preference questions were specified to load on their domain specific factor. Standard deviations are in parentheses. *P* values (two-tailed) for categorical variables were obtained from an ordered logistic regression. For identity strength variables, *p* values are from a *t* test. Correlations are polychoric correlations for the individual items and Pearson correlation coefficients for the identity strength scales.

have a polychoric correlation larger than the correlation for DZ twins. The stronger polychoric correlations among MZ twins for all the items, with the exception of marrying within one's ethnic group, imply some genetic basis for these attitudes. The heightened correlation between the identity strength indicators for MZ twins relative to DZ twins also indicates a strong genetic underpinning to these preferences.

In effect, the *equal environment assumption* treats MZ and DZ twins as if they were assigned at random to the common environment. That is, MZ twins are not socialized to be different than DZ twins and, therefore, both MZ and DZ twins should have the same propensity to form group identities. Since this assumption is central, we partially test it by estimating a series of ordered logistic regressions, where we regress the identification variables on zygosity. For the continuous racial, ethnic, and religion identity strength variables, we conducted t tests comparing MZ and DZ twins. The p values associated with this partial test of the EEA are presented in Table 1. Finding that the MZ and DZ twins evince no statistically significant differences in the means of identity strength variables lends support to the EEA. With the exception of religious marriage, there are no significant differences between MZ and DZ twins.[8]

The Genetic Foundation of Identity

To more systematically analyze these data, we estimated a series of models decomposing the variance in the indicators into additive genetic (A), common environment (C), and unique (E) environmental variance to explore the degree to which genetic and environmental factors contribute to overall variance on these constructs. We estimate the ACE components for identity types using structural equation models. Several specifications were made prior to estimation. First, the A covariance between twin 1 and twin 2 was constrained at 1 for MZ twins and 0.5 for DZ twins, since MZ twins share 100 percent of their genes and DZ twins share 50 percent, on average. The C covariance was constrained at 1, to approximate the shared environment. E is not directly estimated in the model, since the data are categorical and residuals are not estimated; rather, the item thresholds are constrained to be equal across twins. Since the error has a variance of 1, we can estimate E^2 by subtracting A^2 and C^2 from 1.[9] We also present the analysis for the factor scores with the items

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[8] To deal with the violation of this assumption for religious marriage and ethnic identification, we estimated a model below where thresholds are allowed to vary across DZ and MZ twins. It is also important to note that elsewhere the EEA is well defended as empirically (Kendler et al., 1993) and theoretically sound (Medland and Hatemi, 2009:199). Medland and Hatemi (2009) argue that assuming major differences between the political socialization of MZ and DZ twins defies much of what we know about political socialization. We apply the same logic to assume that there should be no differences in the socialization of these different types of twins into ethnic, racial, or religious identifications.

[9] An ordered probit link relates the factors to the items. As such, in the model the residuals have a variance of 1 for model identification.

as indicators (the "identity strength" rows at the bottom of each table). We corrected for age effects in all our models.

The categorical variables—the individual items—were estimated using mean and variance-adjusted weighted least squares, whereas the "identity strength" models were estimated using maximum likelihood. The standard errors were obtained via bootstrapping from 500 simulations. All models were estimated in M*plus* version 6.11.[10]

Table 2 presents the ACE estimates for racial identity; Table 3 is for ethnic identification, and Table 4 religious identification. We first estimated the full ACE model for each item and then compared the change in model fit to a reduced AE or CE model using a Wald test. A nonsignificant p value indicates that either A or C can be dropped without a significant reduction in model fit. The best-fitting models are in bold, with 95 percent confidence intervals in parentheses.

As Lewis and Bates (2010) find, genetic factors account for a large proportion of the variance in racial identification, preference, and marriage. Our estimates of a^2 range from a low of 27 percent for racial identification to a high of 55 percent for racial marriage. In addition, for three of the four variables in Table 2, we find that the role of the common environment is negligible. Indeed, an AE model for racial preference, marriage, and identity strength did not result in a significant decline in model fit, relative to an ACE model (Racial Preference: $\chi^2[1] = 0.48, p = 0.49$; Racial Marriage: $\chi^{22}[1] = 0.02, p = 0.89$; Identity Strength: $\chi^2[1] = 0.35, p = 0.56$). For racial identification, we find that, individually, A and C parameters can be dropped from the model without a significant decline in model fit (drop A: $\chi^2[1] = 1.89$, $p = 0.17$, drop C: $\chi^2[1] = 0$, $p = 1$); however, simultaneously dropping both parameters resulted in a significant decline in model fit. Thus, we specify an ACE model, with the caveat that a^2 is more pronounced than c^2.

We find a similar pattern of results with respect to ethnic identification in Table 3. The variance explained by additive genetic factors was substantial, ranging from 8 percent to 46 percent in the ACE models, whereas common environmental factors explain a negligible proportion of the variance. For ethnic identification, ethnic preference, and the identity strength, c^2 was not statistically different from 0. For most of these variables, the best-fitting model is an AE model. The noteworthy exception is ethnic marriage. For eth-

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[10] We also tested for sex differences. We did this by freeing the genetic and environment parameters to vary across males and females. We then compared the model fit of this unconstrained model to a model where no sex differences exist. If the model fit is not worsened by constraining parameters, one should adopt the more parsimonious model. For every variable, no sex differences emerged. (Religious Identification: χ^2 [2] = 0.82, *ns*; Religious Preference: χ^2 [2] = 0.19, *ns*; Religious Marriage: χ^2 [2] = 0.36, *ns*; Identity Strength (Religion): χ^2 [2] = 0.30; *ns*; Racial Identification: χ^2 [2] = 0.37, *ns*; Racial Preference: χ^2 [2] = 0.98, *ns*; Racial Marriage: χ^2 [2] = 2.65, *ns*; Identity Strength (Race): χ^2 [2] = 1.29, *ns*; Ethnic Identification: χ^2 [2] = 0.14, *ns*; Ethnic Preference: χ^2[2] = 2.21, *ns*; Ethnic Marriage: χ^2[2] = 0.66, *ns*; Identity Strength (Ethnic): χ^2[2] = 1.54; *ns*.)

TABLE 2

Race: Univariate ACE Models

	a^2	c^2	e^2	χ^2	p
Racial Identification					
ACE[a]	**0.27**	**0.00**	**0.73**	Base	
	(0.09, 0.46)	**(−0.10, 0.10)**	**(0.59, 0.87)**		
CE		0.21	0.79	1.89	0.17
		(0.10, 0.32)	(0.68, 0.90)		
AE	0.27		0.73	0	1
	(0.13, 0.41)		(0.59, 0.97)		
Racial Preference					
ACE	0.28	0.09	0.63	Base	
	(0.00, 0.56)	(−0.13, 0.32)	(0.51, 0.74)		
CE		0.31	0.69	2.87	0.09
		(0.22, 0.41)	(0.59, 0.78)		
AE	**0.39**		**0.61**	0.48	0.49
	(0.28, 0.50)		**(0.50, 0.72)**		
Racial Marriage					
ACE	0.52	0.02	0.46	Base	
	(0.31, 0.74)	(−0.14, 0.18)	(0.36, 0.56)		
CE		0.46	0.54	10.11	< 0.01
		(0.38, 0.55)	(0.45, 0.62)		
AE	**0.55**		**0.45**	0.02	0.89
	(0.45, 0.64)		**(0.36, 0.55)**		
Identity Strength (Race)					
ACE	0.34	0.07	0.59	Base	
	(0.12, 0.57)	(−0.11, 0.26)	(0.50, 0.67)		
CE		0.34	0.67	5.94	0.01
		(0.26, 0.41)	(0.60, 0.74)		
AE	**0.42**		**0.58**	0.35	0.56
	(0.34, 0.50)		**(0.50, 0.66)**		

All variables, with the exception of identity strength, are categorical. The identity strength variable was derived from a confirmatory factor model. Thresholds are equated in the categorical models, intercepts are equated in the continuous model. a^2 = variance in the trait attributable to additive genetic factors, c^2 = common environment, and e^2 = unique environment. Ninety-five percent confidence intervals are presented in parentheses. Best-fitting models are in bold and all models are corrected for age effects. Standard errors were bootstrapped from 500 simulations. χ^2 and the associated p values represent the change in model fit dropping either a^2 or c^2 comparing the model fit to the baseline model using a Wald test.

nic marriage, dropping a^2 did not reduce the overall model fit ($\chi^2[1] = 0.16$, $p = 0.69$). After fitting a *CE* model, approximately 37 percent of the variance in ethnic marriage can be explained by common environmental factors.

For religion (Table 4), much of the variance is also explained by genetic factors. In the best-fitting models, genes account for roughly 63 percent of the variance for religious identification, 54 percent of the variance in religious preference, 36 percent of the variance in religious marriage, and 32 percent

TABLE 3

Ethnic: Univariate ACE Models

	a^2	c^2	e^2	χ^2	p
Ethnic Identification					
ACE	0.40	0.00	0.60	Base	
	(0.18, 0.63)	(−0.16, 0.16)	(0.47, 0.70)		
CE		0.32	0.68	4.75	0.03
		(0.21, 0.42)	(0.58, 0.79)		
AE	**0.40**		**0.60**	0.00	1
	(0.28, 0.53)		**(0.47, 0.72)**		
Ethnic Preference					
ACE	0.46	0.00	0.54	Base	
	(0.20, 0.72)	(−0.20, 0.20)	(0.42, 0.67)		
CE		0.36	0.64	5.10	0.02
		(0.26, 0.46)	(0.54, 0.74)		
AE	**0.46**		**0.54**	0.00	1
	(0.34, 0.57)		**(0.43, 0.66)**		
Ethnic Marriage					
ACE	0.08	0.31	0.61	Base	
	(−0.21, 0.37)	(0.06, 0.56)	(0.48, 0.74)		
CE		**0.37**	**0.63**	0.16	0.69
		(0.26, 0.48)	**(0.52, 0.74)**		
AE	0.45		0.55	3.59	0.06
	(0.31, 0.58)		(0.42, 0.69)		
Identity Strength (Ethnicity)					
ACE	0.42	0.00	0.58	Base	
	(0.28, 0.56)	(−0.10, 0.10)	(0.50, 0.66)		
CE		0.30	0.70	66.62	< 0.01
		(0.23, 0.37)	(0.62, 0.77)		
AE	**0.42**		**0.58**	0.00	1
	(0.34, 0.50)		**(0.50, 0.66)**		

All variables, with the exception of identity strength, are categorical. The identity strength variable was derived from a confirmatory factor model. Thresholds are equated in the categorical models; intercepts are equated in the continuous model. a^2 = variance in the trait attributable to additive genetic factors, c^2 = common environment, and e^2 = unique environment. Ninety-five percent confidence intervals are presented in parentheses. Best-fitting models are in bold and all models are corrected for age effects. Standard errors were bootstrapped from 500 simulations. χ^2 and the associated p values represent the change in model fit dropping either a^2 or c^2 comparing the model fit to the baseline model using a Wald test.

of the variance in identity strength. Although an AE model is the best-fitting model for religious identification and preference, an ACE model provided the best fit to data for religious marriage and identity strength. Table 4 illustrates that 21 percent of the variance in religious marriage and 22 percent of the variance in identity strength is explained by the common environment.[11]

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[11] We also fit the religious marriage and religious identification models freeing the thresholds to vary across twin groups, since there were differences between MZ and DZ twins in Table 1.

TABLE 4

Religion: Univariate ACE Models

	a^2	c^2	e^2	χ^2	p
Religious Identification					
ACE	0.48	0.14	0.39	Base	
	(0.20, 0.75)	(−0.09, 0.37)	(0.29, 0.48)		
CE		0.53	0.47	12.50	< 0.01
		(0.46, 0.61)	(0.39, 0.53)		
AE	**0.63**		**0.37**	1.39	0.24
	(0.54, 0.72)		**(0.28, 0.46)**		
Religious Preference					
ACE	0.40	0.12	0.48	Base	
	(0.13, 0.67)	(−0.10, 0.35)	(0.37, 0.58)		
CE		0.45	0.55	7.28	< 0.01
		(0.37, 0.53)	(0.48, 0.63)		
AE	**0.54**		**0.46**	0.95	0.33
	(0.44, 0.63)		**(0.37, 0.56)**		
Religious Marriage					
ACE	**0.36**	**0.21**	**0.43**	Base	
	(0.06, 0.66)	**(−0.05, 0.47)**	**(0.33, 0.53)**		
CE		0.50	0.50	5.65	0.02
		(0.42, 0.57)	(0.43, 0.58)		
AE	0.60		0.40	2.82	0.09
	(0.51, 0.69)		(0.31, 0.49)		
Identity Strength (Religion)					
ACE	**0.32**	**0.22**	**0.46**	Base	
	(0.04, 0.59)	**(−0.01, 0.46)**	**(0.38, 0.54)**		
CE		0.47	0.53	7.11	< 0.01
		(0.40, 0.53)	(0.47, 0.69)		
AE	0.56		0.44	4.47	0.03
	(0.49, 0.63)		(0.37, 0.51)		

All variables, with the exception of identity strength, are categorical. The identity strength variable was derived from a confirmatory factor model. Thresholds are equated in the categorical models; intercepts are equated in the continuous model. a^2 = variance in the trait attributable to additive genetic factors, c^2 = common environment, and e^2 = unique environment. Ninety-five percent confidence intervals are presented in parentheses. Best-fitting models are in bold and all models are corrected for age effects. Standard errors were bootstrapped from 500 simulations. χ^2 and the associated p values represent the change in model fit dropping either a^2 or c^2 comparing the model fit to the baseline model using a Wald test.

Consistent with Lewis and Bates (2010), genetic factors explain a large proportion of the variance in these three identity types. Yet, it remains to be determined whether genetic factors are unique to identification or whether the genetic variance is shared with psychological and motivational characteristics.

The estimates were substantively identical and the change in model fit was nonsignificant for both religious marriage (χ^2 [3] = 3.13, *ns*) and ethnic identification (χ^2 [3] = 4.70, *ns*). This is why we present only the more parsimonious model where the thresholds are constrained to be equal across MZ and DZ groups.

Is the genetic variation in identification shared with personality? To explore this, in the next section we estimate a series of multivariate models examining the extent to which the genetic variance in Tables 2–4 is shared with personality characteristics, or whether there is something unique with respect to identification.

Genes, Personality, and Identification

The MIDUS data include a battery of personality questions meant to approximate the Big-Five personality dimensions of emotional stability, openness, agreeableness, extraversion, and conscientiousness (Lachman and Weaver, 1997). All questions were asked on a four-point scale asking participants to indicate how much a particular adjective describes them.[12] Emotional stability/neuroticism was measured with "moody," "worrying," "nervous," and "calm" ($\alpha = 0.72$, $M = 2.27$, $SD = 0.69$). Extraversion was measured with "outgoing," "friendly," "lively," "active," "talkative," "self-confident," "forceful," "assertive," "outspoken," and "dominant" ($\alpha = 0.85$, $M = 2.97$, $SD = 0.57$). Openness to experience was ascertained using "creative," "imaginative," "intelligent," "curious," "broad-minded," "sophisticated," and "adventurous" ($\alpha = 0.74$, $M = 2.99$, $SD = 0.54$.) Conscientiousness was measured with "organized," "hardworking," "responsible," and "careless" ($\alpha = 0.59$, $M = 3.50$, $SD = 0.48$). And, finally, agreeableness was measured with five items: "helpful," "warm," "caring," "softhearted," and "sympathetic" ($\alpha = 0.80$, $M = 3.53$, $SD = 0.46$).[13]

To examine whether personality characteristics share genetic and environmental variance with our three identity types, we conduct a Cholesky decomposition for each identity variable. This allows us to clarify whether openness, agreeableness, extraversion, emotional stability, and conscientiousness share genetic and environmental variation with the three identification variables. The Cholesky decomposition is informed by an assumption that variables in it are causally ordered (Medland and Hatemi, 2009; Posthuma, 2009). We first enter the five personality items, followed by the identification item, since our theoretical model presupposes personality is theoretically prior to identifying with particular groups. Since we did not have an a priori expectation about the ordering of the personality characteristics, we regressed each of the identity strength variables on the Big-Five traits, obtained beta weights, and entered the personality characteristics in the decomposition based on the relative size of the beta weights (following a similar procedure used by Hatemi

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[12] John (1990:94) indicates that measuring personality using agreement with adjectives is similar to measuring them via agreement with more extensive sentence-based items.

[13] We present the scale properties only for the data we analyze, that is, same-sex twin pairs in the MIDUS data. Our reliability estimates and descriptive statistics may be slightly different from other reports that utilize the entire MIDUS data set.

et al., 2007).[14] The models allow us to examine how much of the genetic and environmental variance in identification is both shared with and unique from personality characteristics.

We start by fitting a full Cholesky model and compare this model to reduced models (following Hatemi et al., 2009). We find that dropping all the common environment paths significantly worsens the model fit (racial: $\chi^2[21] = 45.30$, $p < 0.001$; ethnic: $\chi^2[21] = 35.75, p < 0.001$, religious: $\chi^2[21] = 64.66, p < 0.001$). Yet, dropping the common environment paths to the identity strength variables did not significantly worsen the overall model fit for racial or ethnic identification (racial: $\chi^2[6] = 6.30$, *ns*; ethnic: $\chi^2[6] = 3.02$, *ns*); dropping the common environment paths for religious identification did significantly worsen the model fit (racial: $\chi^2[6] = 26.75, p < 0.01$).

Since the personality paths to identity were nonsignificant in the common environment matrix, we present a reduced Cholesky model in Table 5. That is, we fix the common environment paths to racial and ethnic identification at 0. As such, we only present the A and E matrices. Since these paths were freed in the religious identification model, we present the full Cholesky for religious identification (Table 6). In all models, the residual variances for each variable were fixed at 0 to partition the variance into environmental and genetic components. The models were estimated using maximum likelihood and the tables present standardized path coefficients.

In Table 5, beginning with the racial identification row in the genes matrix, personality characteristics jointly contribute to a negligible portion of the genetic variance. Their combined influence contributes about 3 percent to the genetic variance for racial identity strength ($0.06^2 + 0.12^2 + 0.09^2 + 0.01^2 + 0.05^2$). Personality contributes to a larger portion of the genetic variance for ethnic identity strength (6.3 percent $= 0.17^2 + 0.01^2 + 0.02^2 + 0.07^2 + 0.17^2$). It is important to note that a nontrivial portion of the genetic variance for both racial and ethnic identification is unique to these constructs. After accounting for the shared variation with personality, roughly 41 percent (0.64^2) of the genetic variance is unique to racial identification; 37 percent (0.61^2) is unique to ethnic identification. Although personality characteristics share some of the genetic variation with these identity constructs, much of the genetic variance is unique to the constructs themselves.

The "Identity Strength (Race)" and "Identity Strength (Ethnic)" rows in the environment matrices similarly illustrate that a small portion of the unique environmental variance in identification is shared with personality. Personality contributes about 1 percent to the racial and ethnic environmental variance. The entries in both E6 columns demonstrate that much of the environmental variation is unique to these identity processes—55 percent (0.74^2) for racial identification and 56 percent (0.75^2) ethnic identification.

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[14] For religion, we ordered the variables as follows: openness, agreeableness, extraversion, emotional stability/neuroticism, conscientiousness; for racial identification: openness, extraversion, agreeableness, conscientiousness, emotional stability/neuroticism; for ethnic identification: agreeableness, extraversion, openness, emotional stability/neuroticism, conscientiousness.

TABLE 5

Cholesky Decomposition for Racial and Ethnic Identification

	Racial ID					
Genetic (A)	A1	A2	A3	A4	A5	A6
Openness	0.63					
Extraversion	0.44	0.44				
Agreeable	0.13	0.22	0.48			
Conscientious	0.30	0.30	0.007	0.46		
Neuroticism	−0.39	0.01	−0.05	0.08	0.47	
Identity strength (race)	−0.06	0.12	0.09	0.01	−0.05	0.64
Environment (E)	E1	E2	E3	E4	E5	E6
Openness	0.74					
Extraversion	0.40	0.62				
Agreeable	0.28	0.09	0.77			
Conscientious	0.18	0.05	0.16	0.71		
Neuroticism	−0.09	−0.03	−0.04	−0.17	0.67	
Identity strength (race)	−0.06	0.04	−0.01	0.06	0.01	0.74
	Ethnic ID					
Genetic (A)	A1	A2	A3	A4	A5	A6
Agreeable	0.55					
Extraversion	0.28	0.55				
Openness	0.15	0.42	0.44			
Neuroticism	−0.13	−0.24	−0.26	0.49		
Conscientious	0.19	0.38	−0.01	0.08	0.44	
Identity strength (ethnic)	0.17	0.01	−0.02	0.07	−0.17	0.61
Environment (E)	E1	E2	E3	E4	E5	E6
Agreeable	0.82					
Openness	0.21	0.71				
Extraversion	0.25	0.35	0.61			
Neuroticism	−0.08	−0.06	−0.05	0.69		
Conscientious	0.22	−0.08	0.08	−0.17	0.69	
Identity strength (ethnic)	−0.05	−0.01	−0.04	−0.06	0.07	0.75

Entries are standardized path coefficients. Identity strength consists of factor scores derived from a confirmatory factor model.

On the other hand, turning to religious identification in Table 6, personality contributes 19 percent to the genetic variance ($0.04^2 + 0.17^2 + 0.33^2 + 0.11^2 + 0.20^2$), with 10 percent unique to religious identification (0.31^2). Likewise, much of the common environment variance in religious identification is shared with personality, as indicated by the large entries in Columns C1 through C5 (and the small entry in C6). This suggests that socialization not only explains variation in religious identification, but the same socialization processes that explain variation in religious identification are shared with personality. Again, we find a negligible portion of unique environmental variance associated with

TABLE 6

Cholesky Decomposition for Religious Identification

	Religious ID					
Genetic (A)	A1	A2	A3	A4	A5	A6
Openness	0.62					
Agreeable	0.15	0.52				
Extraversion	0.43	0.20	0.40			
Neuroticism	−0.38	−0.03	−0.01	0.48		
Conscientious	0.29	0.12	0.27	0.08	0.46	
Identity strength (religion)	−0.04	0.17	0.33	0.11	−0.20	0.31
Environment (C)	C1	C2	C3	C4	C5	C6
Openness	0.24					
Agreeable	0.10	0.14				
Extraversion	0.05	−0.20	0.17			
Neuroticism	0.32	0.06	0.14	−0.09		
Conscientious	0.04	0.14	−0.15	−0.06	−0.01	
Identity strength (religion)	−0.16	0.32	−0.06	0.37	0.02	0.00
Environment (E)	E1	E2	E3	E4	E5	E6
Openness	0.75					
Agreeable	0.28	0.78				
Extraversion	0.40	0.07	0.62			
Neuroticism	−0.09	−0.05	−0.02	0.69		
Conscientious	0.18	0.17	0.03	−0.17	0.69	
Identity strength (religion)	−0.01	0.03	−0.03	−0.03	−0.01	0.67

Entries are standardized path coefficients. Identity strength consists of factor scores derived from a confirmatory factor model.

religious identification shared with personality. Indeed, about 45 percent of the unique environmental variance is unique to religious identification (0.67^2).

Discussion

This research contributes to our understanding of group politics as well as the burgeoning research program investigating biological processes in social attitudes and behavior (Hatemi et al., 2009; Lewis and Bates, 2010). Why do groups play such a central role in social and political life? It is not simply a function of common interests and family socialization; rather, in-group favoritism and identities have a genetic basis. In particular, we demonstrate substantial individual differences in in-group orientations, in line with the expectation that humans are balancing a push and pull of group identification and individuation (Brewer, 2007; Snyder and Fromkin, 1980). While we are cautious in our interpretation of these findings given the relatively small number of twin pairs available for analysis in the MIDUS data, we find evidence that these individual differences in in-group orientation are largely attributable to genetic influences. Genes account for a large proportion of variation in racial, ethnic, and religious identification. The unique environments individuals inhabit also influence the extent to which people express in-group attachment.

Further, we find modest support for the hypothesis that Big-Five personality traits and group identifications share genetic etiology. With regard to racial and ethnic identifications, personality contributes to 3 percent and 6.3 percent of the genetic variance in these identifications, respectively. Genetic variation associated with personality affects 19 percent of the genetic variance in religious identification. Far less of the variation in religious identification is attributable to unique genetic influence. Consequently, our findings are mixed: models speculating that personality moderates the influence of genes on social judgments and behavior find support in expressed religious identification, but less in ethnic and racial identifications.

Consistent with Hatemi and colleagues (2009), we find little influence of the common environment on the degree of attachment to racial and ethnic groups. However, we find substantially more influence of the common environment on the development of religious identification. We also find that this is shared with the influence of the common environment on variation in personality traits. Consequently, our findings cannot be interpreted as a rejection of preadult socialization altogether. We speculate that socialization may also affect the formation of group orientations outside the scope of the present investigation. Additive genetics and stable personality traits substantially motivate the tendency to join, but what groups will joiners select? Family socialization should play a role, defining the menu of groups people choose from to form identifications, in terms of ethnic, religious, social, political, or other identity characteristics. Congruent with Tooby and Cosmides (1992), evolution likely instilled a proclivity to identify with social groups; culture fills in the blanks, defining the types of social groups one chooses. Future research should unpack the path-defining role socialization plays in in-group selection.

Our findings comport with the growing research program in political science identifying the role genetic predispositions play in influencing phenotypes related to political behavior. Demonstrating the influence of genetic influences on in-group orientations provokes additional research questions about the heritability of out-group judgments, as well as the role context plays in activating these predispositions. A limitation of our work is that we are unable to identify the contexts under which genetic expression varies. Although humans experience a drive to identify, it is unclear how other factors heighten or dampen this drive. Just as group identification has been shown to vary when groups are competing for finite resources (e.g., Sherif, 1966) and when one's existence is made salient (Pyszczynski, Solomon, and Greenberg, 2003), as well as when there is a social prosperity and economic surplus (Sidanius and Pratto, 2001), it is conceivable that environmental circumstances also modulate the genetic expression of in-group identification. Attending to these, and related, empirical concerns is critical to better understand the nature of social identification, collective action, and group-based politics.

Finally, more research should investigate mechanisms by which genes are linked to such distal phenotypes as group identities and political attitudes. We have taken a modest step investigating the role that personality traits play in connecting genetically influenced predispositions and the formation of group identities. Even though our design only allows us to estimate the *correlation* between personality traits and in-group attachments, the results are consistent with the notion that personality traits may be one of the factors that mediate the relationship between genes and group identities. Nonetheless, while the evidence suggests that there is overlap in the genetic basis of personality and group identity, the overlap is not perfect, and comports with recent work demonstrating a more complex relationship between personality and political attitudes (Verhulst, Hatemi, and Martin, 2010). Future scholarship should be devoted to disentangling these issues, clearly articulating the complex relationships between personality, motivation, affect, and cognition with respect to the genetic basis of social behavior.

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