# Correlations between social dominance orientation and political attitudes reflect common genetic underpinnings

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A foundational question in the social sciences concerns the interplay of underlying causes in the formation of people's political beliefs and prejudices. What role, if any, do genes, environmental influences, or personality dispositions play? Social dominance orientation (SDO), an influential index of people's general attitudes toward intergroup hierarchy, correlates robustly with political beliefs. SDO consists of the subdimensions SDO-dominance (SDO-D), which is the desire people have for some groups to be actively oppressed by others, and SDO-egalitarianism (SDO-E), a preference for intergroup inequality. Using a twin design ($n = 1,987$), we investigate whether the desire for intergroup dominance and inequality makes up a genetically grounded behavioral syndrome. Specifically, we investigate the heritability of SDO, in addition to whether it genetically correlates with support for political policies concerning the distribution of power and resources to different social groups. In addition to moderate heritability estimates for SDO-D and SDO-E (37% and 24%, respectively), we find that the genetic correlation between these subdimensions and political attitudes was overall high (mean genetic correlation 0.51), while the environmental correlation was very low (mean environmental correlation 0.08). This suggests that the relationship between political attitudes and SDO-D and SDO-E is grounded in common genetics, such that the desire for (versus opposition to) intergroup inequality and support for political attitudes that serve to enhance (versus attenuate) societal disparities form convergent strategies for navigating group-based dominance hierarchies.

political attitudes | social dominance | evolution | behavioral genetics | prejudice

**P**hilosophers from Thucydides to Foucault have argued that politics—the distribution of resources, rights, obligations, and sanctions and the negotiation of common rules to justify it (1, 2)—is fundamentally underpinned by the question of who will dominate whom (3): Who will claim preferential access to resources, living conditions, and decision rights, and who must yield? Consistent with this notion, the precursors of politics and negotiations among nonhuman primates also appear to center around issues of hierarchy and coalitional power (4, 5). Indeed, dominance hierarchies occur across species, in which more formidable individuals are more likely to claim and fight for contested resources and territory, whereas less formidable individuals will yield to avoid injury (6). Early ethological observations even demonstrated the formation of stable dominance hierarchies among human infants in daycare centers (7), and recent experimental evidence confirms that human infants understand social dominance and use it to navigate their social world (8, 9).

Egalitarian processes, too, have deep evolutionary roots. In a number of primate species, coalitions form within groups among lower-ranked males to gain access to the resources of those of highest rank (10, 11). Leveling mechanisms directed at keeping anyone from obtaining despotic control also manifest across cultures among hunter-gatherers (4, 10, 11). Representations of

equality or fairness emerge early in ontogeny, and infants who react to uneven distributions among third parties are more likely to share resources themselves, consistent with the notion of a common underlying psychology of resource distribution (12, 13). Together, this evidence demonstrates that representations and motives for dominance versus equality between individuals emerge across phylogenesis and very early in ontogenesis, and across culture and subsistence systems (see also ref. 14), suggesting that they represent evolved, adaptive strategies for navigating the social world.

Hierarchy or equality can be implemented not only within the group but also between groups, maximizing or minimizing the degree to which some coalitions enjoy privileged influence, access to resources, and better conditions of living than do others. Indeed, all known surplus-producing human societies feature some form of hierarchy between social groups (1), and the archaeological and ethnographic records suggest that the human mind evolved in a context of violent coalitional conflict (15, 16). Consistent with this, humans are adept at detecting cooperative coalitions from social cues, and this social alliance detection underpins political cognition and categorization by who-is-allied-to-whom, manifesting already in early childhood (17, 18). Together, this evidence suggests that humans may have evolved predispositions to represent and strategically navigate hierarchy versus equality between groups, as long argued by social dominance theory (1).

> **Significance**
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> Deciphering the underlying psychology of societal attitudes and prejudices is important in times of political unpredictability. We focus on the foundational construct of preference for (or against) hierarchies between groups, as reflected in the 2 subdimensions of social dominance orientation (SDO). Studying SDO with a large-sample twin design, we show that both its sub-dimensions are heritable, share common genetic influences, and overlap genetically with 6 political attitudes that serve to enhance versus attenuate societal hierarchy. This suggests that desire for versus opposition to intergroup hierarchy, in abstract and concrete forms, constitutes a genetically-grounded behavioral syndrome, thus explaining an important part of the long-observed association among political views of various kinds.

Here we investigate whether individual variation in such hierarchical versus egalitarian strategies is partly heritable, while also responding to the environment in which individuals find themselves. Behavioral ecological modeling suggests that the degree to which egalitarian or hierarchical forms of resource distribution will stabilize depends on resource availability and their benefits of consumption, and on the cost of monopolizing them (19). Because the adaptive consequences of hierarchical versus egalitarian strategies also depend on the relational strategies of one's conspecifics (weighing both total expected costs and benefits), and to the extent that people may seek out the ecological niches in which their relational strategies are most adaptive, balancing selection may maintain variation in both strategies within a population, akin to how personality variation is argued to be maintained (refs. 20–24, but see also refs. 25 and 26).

In fact, the degree to which individuals generally endorse or oppose community arrangements where some social groups dominate others is a stable trait reliably varying in human populations, and highly predictive of political and intergroup attitudes (1, 27–50). Such social dominance orientation (SDO) positively predicts policies and ideologies that serve to justify and sustain societal hierarchies governing the distribution of power and resources (such as fiscal conservatism, laissez-faire economics, and harsh punishment of criminals), as well as support for ethnic persecution and warfare (29–32). Conversely, SDO negatively predicts hierarchy-attenuating ideologies (such as socialism, feminism, and multiculturalism) and policies (such as generous social welfare, foreign aid, acceptance of immigrants and asylum seekers, and support for strong workers' unions) (29–32).

At the same time, the proposal that evolved motives for enhancing versus attenuating group-based hierarchies vary meaningfully between individuals, and predict intergroup attitudes across time and context, has generated considerable controversy within social and political psychology: Some researchers have argued that SDO is little more than a context-specific response to particular intergroup relationships, and that its correlation with political attitudes is merely a result of those attitudes being in mind as one completes the SDO scale (51, 52). Here, we investigate the degree to which individual levels of SDO are partly heritable versus shaped solely by the environment, and whether the correlations of SDO with political attitudes concerning the distribution of resources, living conditions, and decision rights reflect common genetics versus shared environmental influences.

Experimental, correlational, and cross-national evidence has demonstrated that SDO is sensitive to context, but in a manner consistent with the perspective on intergroup hierarchy suggested by social dominance theory: Dominance motives, as well as their predictive power, increase among high-status groups as the inequality between groups becomes greater or more salient (1, 30, 35, 38, 39). Also, experimental manipulations that increase SDO cause corresponding changes in political and intergroup attitudes relevant to hierarchy versus equality (38, 39). An individual's level of SDO also reflects the hierarchy-enhancing or attenuating functions of their institutional setting, as well as their organizational and societal position (1, 28–37, 40). Importantly, contextual effects on SDO and downstream political attitudes do not compromise its rank order stability (the fact that individuals who are relatively high on social dominance in one context remain so across other contexts) nor its ability to predict social attitudes over time (1, 29, 30, 35, 41–44).

This pattern of findings parallels recent advances in behavioral ecology, where attention has expanded from the classical focus on how the adaptive constraints of a given context affect all individual animals across the board to encompass the influence of behavioral types or animal personalities (53). Such behavioral types may form a behavioral syndrome across domains and contexts—a suite of traits governing how different organisms respond to the same environmental conditions in different ways, reflecting evolutionary trade-offs within a population across contexts where no single optimal strategy exists (cf. refs. 20, 23, and 54–58). While ideological preferences have often been viewed as socially or contextually determined, it is now well established that they are also influenced by genetics (with heritabilities from a range of cultural settings

typically ranging from 30 to 60%), as are personality traits (59–63). The correlation between personality traits and political attitudes is also well established, and recent evidence using genetically sensitive data suggests that this correlation is grounded in a common genetic factor influencing them both (64). This points to the possibility that SDO and support for policies that enhance or attenuate inequality between groups may also share common genetic origins that underpin a behavioral syndrome regarding intergroup resource distribution and territoriality.

However, the only published behavioral genetic evidence on the heritability of SDO, based on the same small German sample of 394 twin pairs, found a very low (0.07%) (65) or essentially zero (66) heritability and, hence, also that SDO did not share any genetic sources with negative attitudes toward foreigners. Here, we use a random sample of 1,987 Norwegian twins to conduct a more definitive test of the extent to which, if at all, SDO is heritable.

In addition to SDO, we measured support for hierarchy-enhancing policies that monopolize resources and territory and sanction subordinates (strict immigration control, deportation of Roma, severe punishments for criminals, reduced foreign aid) and for hierarchy-attenuating policies (strengthening workers' unions and accepting more asylum seekers), all of which have been previously found to correlate with SDO (31–33, 45, 46, 50). Using standard behavioral genetic analyses, we partition the sample variance into that which is heritable (especially shared by monozygotic [MZ] rather than dizygotic [DZ] pairs of twins), shared by family environment (pertaining equally to MZ and DZ pairs), and the remaining unique environmental variance for each individual twin. This current study presents the strongest test yet of the heritability of SDO. In addition, because recent evidence suggests that SDO consists of 2 facets, we also test the degree to which the genetic and environmental underpinnings of orientations toward social dominance (SDO-D) and egalitarianism (SDO-E) are distinct. Most importantly, the current study enabled us to investigate whether the relationship between SDO and key political attitudes springs from their overlapping environmental influences (environmental correlation), as has been suggested (65, 66), or shared genetic influences (genetic correlation). Evidence for this latter possibility would be consistent with the notion that different levels of SDO reflect different hierarchical or egalitarian behavioral types that coordinate strategies toward territoriality, resource distribution, and punishment across contexts.

## Results

The logic of the twin method consists of analyzing correlational differences between MZ twins, who share all of their genes, and between DZ twins, who share only half of their segregating genes. For descriptive statistics of SDO and political attitudes, and for phenotypic correlations by sex and zygosity group, see *SI Appendix*, Tables S1–S7.

At the phenotypic level, we found that a bidimensional confirmatory factor model of SDO in our sample had superior fit (root-mean-squared error of approximation [RMSEA]: 0.062; comparative fit index [CFI]: 0.916; Tucker–Lewis index [TLI]: 0.902) as compared to a unidimensional confirmatory factor model (RMSEA: 0.121; CFI: 0.678; TLI: 0.628). Men scored significantly higher than women on both SDO-D and SDO-E [$t(863.52) = 3.7165$, $P < 0.001$, and $t(883.14) = 2.9754$, $P < 0.001$, respectively, consistent with previous research (1, 67)]. The effect size (Cohen's $d$) of the sex difference in our sample was 0.26 for SDO-D and 0.18 for SDO-E, smaller than the average effect size for gender differences found in a cross-cultural metaanalysis, 0.43 (47).

### Genetic Modeling.

*Bivariate model.* The MZ correlations were higher than the DZ correlations for both SDO-D and SDO-E, across both sexes, which indicates heritability (*SI Appendix*, Tables S3–S6). For the 6 different biometric models our analysis compared, see *SI Appendix*, Table S8 and methods.

The best-fitting model according to the Akaike Information Criterion (AIC) was the AE Cholesky without sex limitation (*SI Appendix*, Fig. S1). In this model, the overlap between SDO-D and SDO-E is estimated as genetic. Genetic overlap (rA),

however, may include effects that are mediated through environmental mechanisms, as opposed to environmental correlations (rE), which encompass all environmental effects that are independent of genes (68). If the same genetic factor influences both constructs, the genetic correlation is one; if there is no overlap at all, it is zero. The same applies for the environmental correlation. We found that the estimated heritability was 37% for SDO-D and 24% for SDO-E. Their genetic correlation was 0.48 (95% confidence interval [CI]: 0.28 to 0.67), and their environmental correlation was 0.37 (95% CI: 0.29 to 0.45).

Sex limitation models capture the idea that the same factors could cause variation in males and females, but to different degrees (69, 70). This is tested by constraining the latent genetic, nonshared environmental, and shared environmental correlations (rA, rE, and rC) across sex in order to see whether the parameters (a, c, e, left unconstrained) still differ significantly. If they do, in fact, differ, the sex limitation model should show the best fit to the data. The fact that the model without sex limitation fit our data best thus suggests that any differences in the heritability of SDO across the sexes are insignificant.

*Analyses of SDO and political attitudes.* The political attitudes, individually, had heritabilities ranging from 20 to 45% (*SI Appendix,* Table S9). Further, with the exception of "strict immigration control" and "deport the Roma," which both had a 19% effect of shared environment (C), no other attitude had any shared-environment effect.

After finding that the AE model without sex limitation had the best fit for SDO-D and SDO-E, we used this model for our subsequent trivariate analyses of SDO-D, SDO-E, and each of the 6 political attitudes. The genetic and environmental effects on each of the political attitudes are presented in Fig. 1. Within every bar, the SDO-specific genetic and environmental effects that account for variance in the political attitudes are visualized. These particular estimates are based on a trivariate Cholesky model of SDO and the political attitudes (*SI Appendix,* Fig. S2).

Fig. 2 shows the genetic and environmental correlations between SDO-D, SDO-E, and each political attitude. The genetic correlation refers to the overlap in genetic influences on the traits. Similarly, the

unique environmental correlation estimates the amount of overlap the traits have due to the same (nonshared) environmental forces. As seen in Fig. 2, SDO-D, SDO-E, and all of the political attitudes share genetic influence to large degrees (mean genetic correlation = 0.51), but the overlapping unique environmental influences are very low (mean environmental correlation = 0.08).

## Discussion

The distribution of resources such as food, territory, and mates is a critical question for all social species. Dominance hierarchies are the most widely implemented way of governing such distributions, and, as a result, adaptive representations and strategies for navigating them emerge across species and very early in human ontogenesis (see refs. 1, 8, and 9). Once human societies started producing an economic surplus, such dominance hierarchies took an intergroup form. Today, individual differences in endorsement of between-group hierarchy, as tapped by SDO, are a robust predictor across time and contexts of support for policies and attitudes that function to enhance or attenuate the unequal distribution of resources, territory, rights, and sanctions between human groups (1, 29). This suggests that endorsement of, or opposition to, between-group hierarchy and the policies that sustain it build on a universal adaptation for navigating social hierarchies, while exhibiting variation in the manner of a functionally integrated behavioral syndrome. By this account, individual levels of SDO specify variation in support for different types of strategies for navigating the distribution of resources and living conditions. Given the range of ecological conditions (e.g., levels of resource availability) and social contexts (e.g., existing distribution of hierarchical motives in a population) that affect the fitness consequences of one strategy over another, it is unlikely that a single optimal level of hierarchy preference exists. It is thus plausible that balancing selection sustains coordinated heritable variation in hierarchy-relevant attitudes, as has been argued for the case of personality (refs. 20–24, but see also refs. 25 and 26).
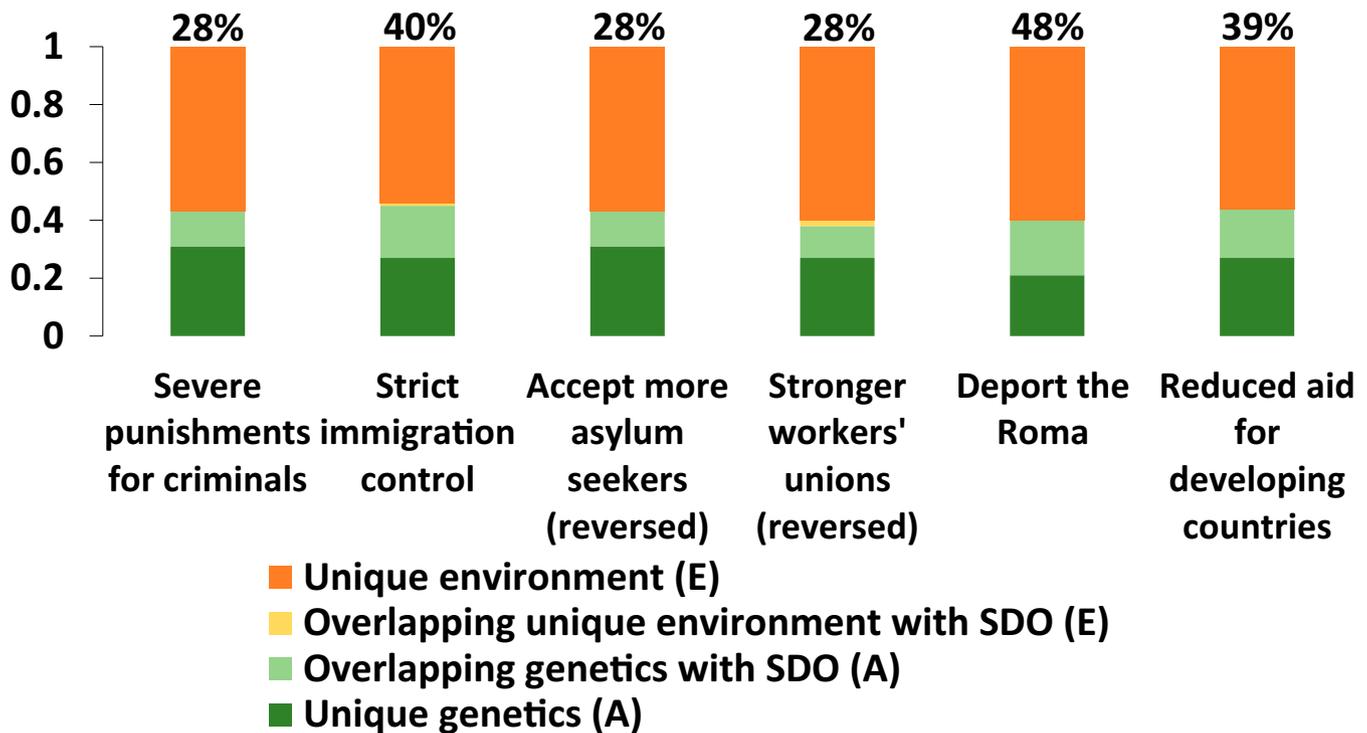
**Fig. 1.** Estimates of A (additive genetics) and E (unique environment) of the political attitudes based on a trivariate Cholesky model (with SDO pooled for SDO-D and SDO-E). The percentages above each bar represent the variance accounted for by genetics overlapping with SDO (the SD of every political attitude is available in *SI Appendix,* Table S2).
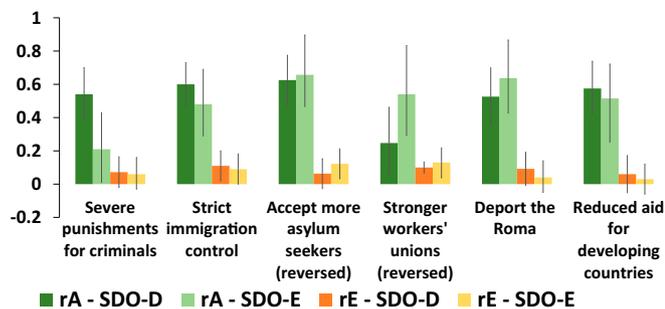
**Fig. 2.** Trivariate estimates of genetic (rA) and environmental correlations (rE) between SDO-D, SDO-E, and support for 6 political policies (with 95% CI).

Such coordinated heritability is precisely what is indicated by the current set of results. It shows, first, that a moderate amount of the variability in both facets of SDO—relating to dominance (SDO-D) and to antiegalitarianism (SDO-E)—is heritable (36% and 24%, respectively). Still, the unique environment for each individual twin explains the largest amount of variance in both SDO and each political attitude. This is consistent with the previously documented role of one's position and role within the societal dominance hierarchy in shaping one's (anti)egalitarian preferences. However, we found no evidence that the family environment shared by twins sets their SDO levels. We also found that a model without sex limitation fit our data best, suggesting that the magnitude of genetic and environmental effects on the phenotypes does not differ significantly between men and women.

The finding of moderate heritability in SDO is in line with research on the behavioral genetics of political attitudes, in particular the negligible role of shared environment, with similar implications for rethinking the classic literature on political socialization (62, 63). It contrasts, however, with accounts of SDO that deny its status as an enduring trait (51, 52) or report that it has no meaningful genetic underpinning (65, 66). Our work differs from this previous behavioral genetics research on SDO, all of which was conducted with the same relatively small sample, in that we use a considerably larger twin sample (708 same-sex twin pairs as opposed to 327 same-sex twin pairs), increasing confidence in the robustness of the current set of estimates. The present sample was also of a markedly older age (mean age 65 y as opposed to 34 y), which is important, given findings that heritability estimates tend to increase with age (71). Finally, it is also possible that the heritability estimates of SDO and related political attitudes found in the current Norwegian sample differ from the previous German sample due to contextual factors and gene−environment interactions. For example, given Germany's recent history, the expression of prejudiced attitudes toward other groups might potentially be subject to stronger social desirability effects such that the measurement of prejudice would be less reliable, making it harder to pick up any heritability effects on SDO. Moving from separate heritability estimates to an analysis of the latent structure of correlations, we demonstrated moderately sized genetic (0.48) and nonshared environmental (0.37) correlations between SDO-D and SDO-E. This implies not only that a substantial portion of the genetic influences on one dimension of SDO also affect the other dimension, but also that each dimension is influenced in similar ways by the unique environments experienced by each individual twin, but not shared with their twin.

Even more significant is the finding that both facets of SDO are moderately genetically correlated with 6 specific political attitudes with hierarchy-enhancing versus attenuating implications for the distribution of territory, resources, and sanctions in society. In other words, substantial parts of the genetic variance underlying each political attitude are overlapping with the genetic variance of both SDO-D and SDO-E. In contrast, this is not the case for the environmental variance underlying the SDO subdimensions; we found no evidence that this environmental variance is overlapping with

the environmental variance underlying specific political attitudes, i.e., that the same environmental experiences shape both SDO and political attitudes in a convergent manner. The finding of correlated genetic influences without correlated environmental influences is unlikely due to the role of measurement error in the latter, as we found both genetic and environmental correlations among the SDO subdimensions. Furthermore, to the extent that SDO can be considered a stable, general trait, these results are in line with earlier behavioral genetics evidence that the covariance between personality traits and political attitudes is due to shared latent genetic factors (72).

While the idea that orientation toward intergroup hierarchy is a genetically grounded behavioral syndrome addresses one persistent question concerning the origin of political attitudes and their co-variation, it raises several other questions. Most notably, the present results do not speak to the specific ways in which such coordinated heritable variation is grounded in molecular genetics and correlated with the environmental exposure, nor sustained at the population level. We have suggested a role for processes of balancing selection broadly construed, the plausibility of which depends on the emergence of empirical work directly testing specific selective mechanisms at the population level, in a manner consistent with evidence at the molecular level on the inheritance of genetic polymorphisms (20, 21).

An important question is what factors feed into the selection of hierarchical versus egalitarian attitudes. In line with the notion of facultative adaptations (25) and the importance of gene-by-environment interactions (73), a universal ability to navigate social hierarchy will likely manifest in a particular orientation toward hierarchy for any one individual at any one place and time by drawing on multiple sources of influence. We conjecture that these sources include inherited individual genetic attitudinal proclivities and components of embodied capital such as formidability, along with ecological factors such as the nature of the surrounding intergroup hierarchy, one's position within it, and the existing distribution of (anti)egalitarian behavioral strategies. For example, an individual with strong innate fighting ability and capacity to form alliances may be more likely to inherit a tendency toward relatively high SDO-D, and, with it, high SDO-E and antiegalitarian political views. When placed near the top of a highly unequal society with large rewards for success, in which some (but not too many) others also value hierarchy, these biological proclivities might manifest as a strong orientation in favor of intergroup dominance and inequality, and, with it, support for political policies that enhance such inequality. Evidence on the interplay between dispositional and structural factors in political psychology is consistent with such a pattern (34), while the potential role of balancing selection in this process suggests that variation in both hierarchical and egalitarian phenotypes may be maintained at the population level (20–25), as is observed cross-nationally (34, 36, 37, 47–49). These population and ecological variations would support complex temporal dynamics and equilibria of intergroup relations unfolding across country and time period, as is found in the historical record (74).

There are, of course, important caveats to be considered alongside the current findings. As with all twin studies, our research is subject to the critique that potential violations of the assumption that MZ and DZ twins are treated equally similarly (i.e., the equal environments assumption) will lead to inflated heritability estimates. Note, however, that the impact of such violations on heritability estimates was found to be small to negligible when directly tested in the case of ideology (75). As with all studies, the heritability and correlation estimates are also limited to the current sample (i.e., in terms of age, culture, ethnicity, and socioeconomic status). This matters, as prior research demonstrates that macrostructural inequality increases SDO levels among dominant groups across nations (34, 36, 47). Thus, while we found no effect of shared (family) environment on SDO within this sample of Norwegian twins, we would likely have found a shared (national) environment effect of macrostructural inequality on SDO, had we been able to sample twins cross-nationally.

Recent multilevel research also indicates that, while average SDO levels among dominant groups are set across nations and states by their macrostructural inequality, the downstream effects of SDO on negative intergroup attitudes and violence nevertheless occur at the individual, psychological level, rather than at the macrostructural

level (34). This finding is fully compatible with the present result that the correlations between SDO and intergroup political attitudes reflect shared genetic underpinnings that adjust both in a convergent manner, rather than shared environmental influences.

As we have outlined above, all heritable characteristics are realized in the environment of the world and so the fact that a predisposition is heritable does not mean it operates in a vacuum from the environment. It is likely that people actively select and shape their environment based on their heritable traits (active gene–environment correlation). This might imply, for instance, that 2 MZ twins are more likely to choose hierarchy-enhancing (versus attenuating) environments that further increase (versus decrease) their support for (or opposition to) intergroup hierarchy because of their shared, inherited dispositions for high (versus low) levels of SDO. Indicative of such a causal pathway is existing evidence that SDO predicts self-selection to both hierarchy-enhancing roles and contexts of socialization (1, 28, 40). Indeed, this ecological niche-picking of contexts in which one's degree of hierarchy-enhancing versus attenuating motives will be most adaptive may help balancing selection sustain heritable variation in both types of strategies in the population (20–24). In addition, different environments may, in turn, trigger differential expression of genetic differences in SDO, a case of gene–environment interaction. Although such active gene–environment correlations and interactions may account for some of the genetic correlation between SDO and political attitudes, we concur with political behavioral geneticists and philosophers of biology (68, 75, 76) that any such mediating and moderating role for environment of the upstream impact of genetics is appropriately included as part of broad-sense heritability.

These results add to emerging evidence that the associations of myriad social psychological phenomena are at least partly genetically underpinned in this broad sense. Specifically, they suggest that both specific political attitudes and more broad preferences for or against hierarchies are deeply embedded and interrelated as a behavioral syndrome at the individual level in human nature. They lend credence to an account in which different kinds of orientations toward intergroup hierarchy, ranging from strong preferences in favor of inequality to strong preferences against it, constitute partly heritable, coordinated strategies for resolving dilemmas regarding the distribution and monopolization of power and resources, which are nevertheless input-sensitive by design. Combined with research on the genetics of other components of political attitudes, they support a literal interpretation of the saying that humans are, indeed, a political animal.

## Methods

**Sample.** The twins were recruited from the Norwegian Twin Registry (NTR), which consists of several cohorts of twins (77). This cohort, as registered by the NTR, consisted only of same-sex twins. The current study drew a random sample from the cohort born between 1945 and 1960, and the questionnaire was filled out in 2016. The mean age was 63.5 y (SD = 4.49 y). The target sample was 3,090 twins, and the final sample was 1,987 twins, yielding a response rate of 64%. We had 1,416 pair responders, and 571 single responders. For complete pairs with valid SDO scores, our sample consists of 131 male MZ, 204 female MZ, 127 male DZ, and 194 female DZ twin pairs. Zygosity has been determined by a questionnaire shown to correctly classify 97 to 98% of the twins (78). Our study was approved by the Regional Committee for Medical and Health Research Ethics of South-East Norway. Informed consent was obtained from all research participants, and all methods were performed according to the relevant guidelines and regulations.

**Measures.** The participants completed a Norwegian translation of the SDO-7 scale. The SDO scale consists of 8 items measuring SDO-D, such as, "Some groups of people must be kept in their place," and 8 items measuring SDO-E, such as, "We should not push for group equality" (reverse-coded). Heeding methodological warnings that respondents may not reliably process and respond to negative-worded items (79), all SDO-7 items were administered protrait (for group dominance or for group equality, respectively) to avoid having 2 mutually opposing negatively worded sets of items (against group dominance and group equality, respectively). For the analyses of support for political policies, we used the following 6 attitudes, measured as support for or against on a 7-point scale ranging from –3 to +3: 1, severe punishments for criminals; 2, strict immigration control; 3, accept more asylum seekers; 4, stronger workers' unions; 5, deport the Roma (a European itinerant ethnic group); and 6, reduced aid for developing countries.

**Twin Method.** MZ twins are genetically identical, while DZ twins share, on average, only half of their segregating genes. All twins are born at the same time, and the twins analyzed here grew up together. The differential genetic overlap is the only thing that separates MZ twins from DZ twins. This allows us to decompose the variance into additive genetic effects (A), shared environmental effects (C; e.g., shared experiences within the family, interacting with the same peers), and unique environmental effects (E; e.g., experiences specific to the individual) (69). In univariate twin analysis, this decomposition of variance is estimated for one single phenotype at a time. Just as this can be done for variation in a single trait, the analysis can be expanded to partition the covariation between several phenotypes, resulting in multivariate twin analysis. Further, we can compare a full ACE model with a simpler AE or CE model to see whether dropping the effects of shared environment and/or additive genetic effects leads to a worse or better fit to the observed data (E is always included because it contains all of the measurement error).

**Twin Analyses.** For our initial bivariate model of SDO-D and SDO-E, we ran and compared 6 biometric nested models (*SI Appendix*, Table S8). We selected these models because it allowed us to test whether 3 variance components (A, C, and E) are necessary, or whether a more parsimonious model was sufficient. Further, they allowed us to test whether any genetic effects are shared or unique, and to see whether there are any quantitative sex differences. All of our model parameters are based on the Cholesky model (69). A Cholesky model is a structural equation model where the A, C, and E components are latent variables and the measured phenotypes are observed variables. The first latent variable loads on the first measured variable and all of the remaining ones. The second latent variable loads on the second observed variable and all of the remaining observed variables, and so on (80). The Cholesky model can be transformed into a "correlated factor solution," where every variable is separately decomposed into genetic and environmental components and the correlation between those is estimated (80).

Our full model was a Cholesky model with scalar sex limitation, containing additive genetic variance (A), and shared (C) and unique (E) environmental influences. In scalar sex limitation models, parameters are allowed to vary across the sexes, but the genetic correlation (rA), shared environmental correlation (rC), and unique environmental correlation (rE) are constrained to be equal for females and males (see ref. 70). The second bivariate model is similar, except that the effects of the shared environment are removed. The third model is a full ACE model again but without sex limitation (all of the remaining models are without sex limitation). The fourth model is an AE model, meaning it is without the effects of the shared environment (C). The fifth model is an AE model where the effect of additive genetics that is specific to the second variable (SDO-E) is reduced to zero. This is to check whether all of the genetic variance of the 2 components is explained by the genetic effects specific to SDO-D. In the sixth and final model, only the common A is dropped to zero. That is, the effect of SDO-D–specific genetic effects on SDO-E is reduced to zero, leaving only the genetic effect that is specific to SDO-D and SDO-E intact. All model parameters were estimated using full information maximum likelihood, by means of the R package OpenMx (81). AIC was used as the measure of fit of our models, and hence as the identifier of the best-fitting model (82).

The best-fitting model, namely the AE model without sex limitation, was the basis for the trivariate analyses of SDO-D, SDO-E, and the 6 political policies.

1. J. Sidanius, F. Pratto, *Social Dominance: An Intergroup Theory of Social Hierarchy and Oppression* (Cambridge University Press, Cambridge, UK, 1999).
2. M. B. Petersen, "Evolutionary political psychology" in *The Handbook of Evolutionary Psychology*, D. M. Buss, Ed. (Wiley, Hoboken, NJ, 2015), vol. 2, pp 1084–1102.
3. P. E. Tetlock, "Psychology and politics: The challenges of integrating levels of analysis in social science" in *Social Psychology: Handbook of Basic Principles*, A. W. Kruglanski, T. E. Higgins, Eds. (Guildford Press, New York, NY, ed. 2, 2007), pp 888–912.
4. C. Boehm, *Hierarchy in the Forest: The Evolution of Egalitarian Behavior* (Harvard University Press, Cambridge, MA, 1999).

5. D. P. Watts, "Dominance, power, and politics in nonhuman and human primates" in *Mind the Gap*, P. Kappeler, J. Silk, Eds. (Springer, Berlin, Germany, 2010), pp. 109–138.
6. J. M. Smith, G. R. Price, The logic of animal conflict. *Nature* **246**, 15–18 (1973).
7. R. Bakeman, J. R. Brownlee, "Social rules governing object conflicts in toddlers and preschoolers" in *Peer Relationships and Social Skills in Childhood*, K. H. Rubin, H. S. Ross, Eds. (Springer, 1982), pp. 99–111.
8. L. Thomsen, W. E. Frankenhuis, M. Ingold-Smith, S. Carey, Big and mighty: Preverbal infants mentally represent social dominance. *Science* **331**, 477–480 (2011).

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9. A. J. Thomas, L. Thomsen, A. F. Lukowski, M. Abramyan, B. W. Sarnecka, Toddlers prefer those who win but not when they win by force. *Nat. Hum. Behav.* **2**, 662–669 (2018).

10. S. A. Pandit, C. P. van Schaik, A model for leveling coalitions among primate males: Toward a theory of egalitarianism. *Behav. Ecol. Sociobiol.* **55**, 161–168 (2003).

11. A. H. Harcourt, F. De Waal, *Coalitions and Alliances in Humans and Other Animals* (Oxford University Press, Oxford, UK, 1992).

12. A. Geraci, L. Surian, The developmental roots of fairness: Infants' reactions to equal and unequal distributions of resources. *Dev. Sci.* **14**, 1012–1020 (2011).

13. J. A. Sommerville, E. A. Enright, The origins of infants' fairness concerns and links to prosocial behavior. *Curr. Opin. Psychol.* **20**, 117–121 (2018).

14. J. Sheehy-Skeffington, L. Thomsen, A theory of how evolved psychology underpins attitudes towards societal economics must go beyond exchanges and averages. *Behav. Brain Sci.* **41**, e187 (2018).

15. J. Tooby, L. Cosmides, "Groups in mind: The coalitional roots of war and morality" in *Human Morality and Sociality: Evolutionary and Comparative Perspectives*, H. Høgh-Olesen, Ed. (Palgrave MacMillan, New York, NY, 2010), pp. 191–234.

16. J-K. Choi, S. Bowles, The coevolution of parochial altruism and war. *Science* **318**, 636–640 (2007).

17. D. Pietraszewski, T. C. German, Coalitional psychology on the playground: Reasoning about indirect social consequences in preschoolers and adults. *Cognition* **126**, 352–363 (2013).

18. A. Pun, S. A. Birch, A. S. Baron, Infants use relative numerical group size to infer social dominance. *Proc. Natl. Acad. Sci. U.S.A.* **113**, 2376–2381 (2016).

19. D. Nettle, K. Panchanathan, T. S. Rai, A. P. Fiske, The evolution of giving, sharing, and lotteries. *Curr. Anthropol.* **52**, 747–756 (2011).

20. D. Nettle, The evolution of personality variation in humans and other animals. *Am. Psychol.* **61**, 622–631 (2006).

21. L. Penke, M. Jokela, The evolutionary genetics of personality revisited. *Curr. Opin. Psychol.* **7**, 104–109 (2016).

22. M. Wolf, J. M. McNamara, On the evolution of personalities via frequency-dependent selection. *Am. Nat.* **179**, 679–692 (2012).

23. L. Penke, J. J. A. Denissen, G. Miller, The evolutionary genetics of personality. *Eur. J. Pers.* **21**, 549–587 (2007).

24. R. C. Arslan, L. Penke, "Evolutionary genetics" in *The Handbook of Evolutionary Psychology*, D. M. Buss, Ed. (Wiley, Hoboken, NJ, 2015), vol. 2, pp. 1047–1066.

25. J. Tooby, L. Cosmides, "The theoretical foundations of evolutionary psychology" in *The Handbook of Evolutionary Psychology*, D. M. Buss, Ed. (Wiley, Hoboken, NJ, 2015), vol. 1, pp. 3–87.

26. J. Tooby, L. Cosmides, On the universality of human nature and the uniqueness of the individual: The role of genetics and adaptation. *J. Pers.* **58**, 17–67 (1990).

27. J. Sidanius, "The psychology of group conflict and the dynamics of oppression: A social dominance perspective" in *Explorations in Political Psychology*, S. Iyengar, W. J. McGuire, Eds. (Duke Studies in Political Psychology, Duke University Press, Durham, NC, 1993), pp. 183–219.

28. J. Gatto, M. Dambrun, Authoritarianism, social dominance, and prejudice among junior police officers. *Soc. Psychol.* **43**, 61–66 (2012).

29. J. Sidanius, S. Cotterill, J. Sheehy-Skeffington, N. S. Kteily, H. Carvacho, "Social dominance theory: Explorations in the psychology of oppression" in *The Cambridge Handbook of the Psychology of Prejudice*, C. G. Sibley, F. K. Barlow, Eds. (Cambridge University Press, Cambridge, UK, 2016), pp. 149–187.

30. F. Pratto, J. Sidanius, S. Levin, Social dominance theory and the dynamics of intergroup relations: Taking stock and looking forward. *Eur. Rev. Soc. Psychol.* **17**, 271–320 (2006).

31. A. K. Ho et al., The nature of social dominance orientation: Theorizing and measuring preferences for intergroup inequality using the new SDO₇ scale. *J. Pers. Soc. Psychol.* **109**, 1003–1028 (2015).

32. A. K. Ho et al., Social dominance orientation: Revisiting the structure and function of a variable predicting social and political attitudes. *Pers. Soc. Psychol. Bull.* **38**, 583–606 (2012).

33. L. Thomsen, E. G. Green, J. Sidanius, We will hunt them down: How social dominance orientation and right-wing authoritarianism fuel ethnic persecution of immigrants in fundamentally different ways. *J. Exp. Soc. Psychol.* **44**, 1455–1464 (2008).

34. J. R. Kunst, R. Fischer, J. Sidanius, L. Thomsen, Preferences for group dominance track and mediate the effects of macro-level social inequality and violence across societies. *Proc. Natl. Acad. Sci. U.S.A.* **114**, 5407–5412 (2017).

35. S. Levin, Perceived group status differences and the effects of gender, ethnicity, and religion on social dominance orientation. *Polit. Psychol.* **25**, 31–48 (2004).

36. S. Vargas-Salfate, D. Paez, J. H. Liu, F. Pratto, H. Gil de Zúñiga, A comparison of social dominance theory and system justification: The role of social status in 19 nations. *Pers. Soc. Psychol. Bull.* **44**, 1060–1076 (2018).

37. F. Pratto et al., Social dominance in context and in individuals: Contextual moderation of robust effects of social dominance orientation in 15 languages and 20 countries. *Soc. Psychol. Personal. Sci.* **4**, 587–599 (2013).

38. S. Levin, J. Sidanius, Social dominance and social identity in the United States and Israel: Ingroup favoritism or outgroup derogation? *Polit. Psychol.* **20**, 99–126 (1999).

39. J. Sidanius, F. Pratto, C. Van Laar, S. Levin, Social dominance theory: Its agenda and method. *Polit. Psychol.* **25**, 845–880 (2004).

40. H. Haley, J. Sidanius, Person-organization congruence and the maintenance of group-based social hierarchy: A social dominance perspective. *Group Process. Intergroup Relat.* **8**, 187–203 (2005).

41. C. G. Sibley, J. Duckitt, The ideological legitimation of the status quo: Longitudinal tests of a social dominance model. *Polit. Psychol.* **31**, 109–137 (2010).

42. L. Thomsen et al., Wolves in sheep's clothing: SDO asymmetrically predicts perceived ethnic victimization among white and Latino students across three years. *Pers. Soc. Psychol. Bull.* **36**, 225–238 (2010).

43. C. Bratt, J. Sidanius, J. Sheehy-Skeffington, Shaping the development of prejudice: Latent growth modeling of the influence of social dominance orientation on outgroup affect in youth. *Pers. Soc. Psychol. Bull.* **42**, 1617–1634 (2016).

44. N. S. Kteily, J. Sidanius, S. Levin, Social dominance orientation: Cause or 'mere effect'?: Evidence for SDO as a causal predictor of prejudice and discrimination against ethnic and racial outgroups. *J. Exp. Soc. Psychol.* **47**, 208–214 (2011).

45. E. G. Green, L. Thomsen, J. Sidanius, C. Staerklé, P. Potanina, Reactions to crime as a hierarchy regulating strategy: The moderating role of social dominance orientation. *Soc. Justice Res.* **22**, 416 (2009).

46. F. Pratto, L. M. Stallworth, S. Conway-Lanz, Social dominance orientation and the ideological legitimization of social policy. *J. Appl. Soc. Psychol.* **28**, 1853–1875 (1998).

47. I.-C. Lee, F. Pratto, B. T. Johnson, Intergroup consensus/disagreement in support of group-based hierarchy: An examination of socio-structural and psycho-cultural factors. *Psychol. Bull.* **137**, 1029–1064 (2011).

48. J. Sidanius, S. Levin, J. Liu, F. Pratto, Social dominance orientation, anti-egalitarianism and the political psychology of gender: An extension and cross-cultural replication. *Eur. J. Soc. Psychol.* **30**, 41–67 (2000).

49. T. L. Milfont et al., On the relation between social dominance orientation and environmentalism: A 25-nation study. *Soc. Psychol. Personal. Sci.* **9**, 802–814 (2018).

50. J. Sidanius, J. H. Liu, J. S. Shaw, F. Pratto, Social dominance orientation, hierarchy attenuators and hierarchy enhancers: Social dominance theory and the criminal justice system. *J. Appl. Soc. Psychol.* **24**, 338–366 (1994).

51. M. T. Schmitt, N. R. Branscombe, D. M. Kappen, Attitudes toward group-based inequality: Social dominance or social identity? *Br. J. Soc. Psychol.* **42**, 161–186 (2003).

52. J. C. Turner, K. J. Reynolds, Why social dominance theory has been falsified. *Br. J. Soc. Psychol.* **42**, 199–206 (2003). Discussion in: *Br. J. Soc. Psychol.* **42**, 215–223 (2003).

53. M. Wolf, F. J. Weissing, Animal personalities: Consequences for ecology and evolution. *Trends Ecol. Evol. (Amst.)* **27**, 452–461 (2012).

54. A. Sih, A. Bell, J. C. Johnson, Behavioral syndromes: An ecological and evolutionary overview. *Trends Ecol. Evol. (Amst.)* **19**, 372–378 (2004).

55. A. Sih, A. M. Bell, Insights for behavioral ecology from behavioral syndromes. *Adv. Stud. Behav.* **38**, 227–281 (2008).

56. D. Réale, S. M. Reader, D. Sol, P. T. McDougall, N. J. Dingemanse, Integrating animal temperament within ecology and evolution. *Biol. Rev. Camb. Philos. Soc.* **82**, 291–318 (2007).

57. N. J. Dingemanse, M. Wolf, Recent models for adaptive personality differences: A review. *Philos. Trans. R. Soc. Lond. B Biol. Sci.* **365**, 3947–3958 (2010).

58. W. Mischel, Y. Shoda, A cognitive-affective system theory of personality: Reconceptualizing situations, dispositions, dynamics, and invariance in personality structure. *Psychol. Rev.* **102**, 246–268 (1995).

59. T. J. Bouchard, Jr, M. McGue, Genetic and environmental influences on human psychological differences. *J. Neurobiol.* **54**, 4–45 (2003).

60. J. R. Alford, C. L. Funk, J. R. Hibbing, Are political orientations genetically transmitted? *Am. Polit. Sci. Rev.* **99**, 153–167 (2005).

61. K. L. Jang, W. J. Livesley, P. A. Vernon, Heritability of the big five personality dimensions and their facets: A twin study. *J. Pers.* **64**, 577–591 (1996).

62. J. E. Settle, C. T. Dawes, J. H. Fowler, The heritability of partisan attachment. *Polit. Res. Q.* **62**, 601–613 (2009).

63. P. K. Hatemi et al., Genetic influences on political ideologies: Twin analyses of 19 measures of political ideologies from five democracies and genome-wide findings from three populations. *Behav. Genet.* **44**, 282–294 (2014).

64. B. Verhulst, L. J. Eaves, P. K. Hatemi, Correlation not causation: The relationship between personality traits and political ideologies. *Am. J. Pol. Sci.* **56**, 34–51 (2012).

65. C. Kandler, E. Bell, R. Riemann, The structure and sources of right-wing authoritarianism and social dominance orientation. *Eur. J. Pers.* **30**, 406–420 (2016).

66. C. Kandler, G. J. Lewis, L. H. Feldhaus, R. Riemann, The genetic and environmental roots of variance in negativity toward foreign nationals. *Behav. Genet.* **45**, 181–199 (2015).

67. J. Sidanius, F. Pratto, L. Bobo, Social dominance orientation and the political psychology of gender: A case of invariance? *J. Pers. Soc. Psychol.* **67**, 998 (1994).

68. K. E. Lynch, P. Bourrat, Interpreting heritability causally. *Philos. Sci.* **84**, 14–34 (2017).

69. M. C. Neale, H. H. M. Maes, *Methodology for Genetic Studies of Twins and Families* (Kluwer Academic, Dordrecht, The Netherlands, 2004).

70. M. C. Neale, E. Røysamb, K. Jacobson, Multivariate genetic analysis of sex limitation and G x E interaction. *Twin Res. Hum. Genet.* **9**, 481–489 (2006).

71. R. Plomin, J. C. DeFries, V. S. Knopik, J. M. Neiderhiser, Top 10 replicated findings from behavioral genetics. *Perspect. Psychol. Sci.* **11**, 3–23 (2016).

72. P. K. Hatemi et al., Genetic and environmental transmission of political attitudes over a life time. *J. Polit.* **71**, 1141–1156 (2009).

73. S. B. Manuck, J. M. McCaffery, Gene-environment interaction. *Annu. Rev. Psychol.* **65**, 41–70 (2014).

74. P. Turchin, *Complex Population Dynamics: A Theoretical/Empirical Synthesis* (Princeton University Press, 2003).

75. K. Smith et al., Biology, ideology, and epistemology: How do we know political attitudes are inherited and why should we care? *Am. J. Pol. Sci.* **56**, 17–33 (2012).

76. K. E. Lynch, Heritability and causal reasoning. *Biol. Philos.* **32**, 25–49 (2017).

77. T. S. Nilsen et al., The Norwegian Twin Registry from a public health perspective: A research update. *Twin Res. Hum. Genet.* **16**, 285–295 (2013).

78. P. Magnus, K. Berg, W. E. Nance, Predicting zygosity in Norwegian twin pairs born 1915-1960. *Clin. Genet.* **24**, 103–112 (1983).

79. M. J. Roszkowski, M. Soven, Shifting gears: Consequences of including two negatively worded items in the middle of a positively worded questionnaire. *Assess. Eval. High. Educ.* **35**, 113–130 (2010).

80. J. C. Loehlin, The Cholesky approach: A cautionary note. *Behav. Genet.* **26**, 65–69 (1996).

81. M. C. Neale et al., OpenMx 2.0: Extended structural equation and statistical modeling. *Psychometrika* **81**, 535–549 (2016).

82. H. Akaike, Factor analysis and AIC. *Psychometrika* **52**, 317–332 (1987).