

Supporting Information

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Additional Information on Measures

Remote Associates Task. The compound RAT has been used as a measure of cognitive flexibility in previous literature (1–4), and measures the degree to which participants are able to restructure their thinking after identifying a semantic association between some, but not all, of the cue words. For instance, when presented with “tooth,” “potato,” and “heart,” participants often tend to first generate “ache” as a compound word solution (toothache, heartache); however, successful participants overcome this initial association and are able to flexibly reevaluate the cues so as to arrive at the correct solution that also connects to the third cue word, namely “sweet” (sweet tooth, sweet potato, sweetheart). RAT performance can therefore generate insight about the way in which established associative networks and conceptual categories are internally arranged, accessed, and flexibly explored.

Dependence on Routines. Items included: (i) “I hate it when my routines are disrupted,” (ii) “I tend to change my plans last minute” (reverse-coded), (iii) “I avoid situations where unexpected things might happen,” (iv) “traditions are important to me,” (v) “rituals are important even if they are not enjoyable,” (vi) “I like to have a regular, unchanging schedule,” (vii) “vacations often cause me stress,” and (viii) “I always go on vacation to the same destination” (Cronbach’s $\alpha = 0.78$). All items were evaluated on a 7-item Likert scale ranging from 1 (not at all characteristic of me) to 5 (entirely characteristic of me).

Nationalism. Items taken from refs. 5–7 included: (i) “To maintain our country’s economic superiority, aggressive economic policies are sometimes necessary,” (ii) “generally, the more influence the UK has on other nations, the better off they are,” (iii) “we should do anything necessary to increase the power of our country, even if it means war,” (iv) “the UK should not dominate other countries” (reverse-coded), (v) “there are many other cultures in the world that are superior to ours” (reverse-coded), and (vi) “for the most part, the UK is no more superior than any other industrialized country in the world” (reverse-coded). The items’ presentation order was randomized for each participant.

Political Conservatism. Political ideology was assessed by asking participants to indicate their political party affiliation in the United Kingdom; participants responded to the question “which of the following political parties best represents your views?” and were able to choose between “Conservative Party” ($n = 63$), “Labour Party” ($n = 70$), “Liberal Democrats” ($n = 62$), “Scottish National Party” ($n = 12$), “UK Independence Party” (UKIP; $n = 21$), “Green Party” ($n = 41$), “Plaid Cymru” ($n = 4$), “Democratic Unionist Party” (DUP; $n = 2$), and “don’t know/other/prefer not to say” ($n = 57$). To quantify these party affiliations along a left–right political conservatism spectrum, we consulted a research report by YouGov, a specialist in polling demographically representative samples, published on September 29, 2017, which reported data collected from 46,643 participants across the United Kingdom in June 2017. In this report, YouGov provides data regarding participants’ self-identification on the left–right political spectrum in relation to their past voting behavior in the 2015 election. For each political party, we calculated a ratio of the percentage of participants who self-identified as “very or fairly right wing” (for the Conservative Party and UKIP) or “very or fairly left wing” (for all other political parties) divided by the percentage of participants who identified as “centre or slightly left/right of centre.” This pro-

vided a proxy measure of the level of right-wing conservatism of each political party. These calculations provided the following conservatism scores for each political party: UKIP (+2.27), Conservative Party (+1.55), Liberal Democrats (–0.64), Plaid Cymru (–1.00), Scottish National Party (–1.75), Labour Party (–2.5), and Green Party (–5.5). There were no data for the Democratic Unionist Party (however, since only two participants in our sample affiliated with the DUP, this did not hinder the analysis). Each participant’s level of conservatism was therefore matched to the estimation of their political party’s right-wing conservatism.

System Justification. The system justification scale comprised eight items from Kay and Jost’s (8) measure: (i) “In general, British society is just and fair,” (ii) “in general, the British political system operates as it should,” (iii) “British society needs to be radically restructured” (reverse-coded), (iv) “the UK is the best country in the world to live in,” (v) “in the UK, most policies serve the greater good,” (vi) “in the UK, everyone has a fair shot at wealth and happiness,” (vii) “British society is getting worse every year” (reverse-coded), and (viii) “British society is set up so that people usually get what they deserve.” All items were randomly ordered. Cronbach’s α was 0.88.

Relationship Between Brexit Voting Behavior and Brexit Attitudes. To evaluate the strength of the relationship between Brexit voting behavior and Brexit-related attitudes, we tested for differences in the attitude measures between Remain and Leave voters. Univariate Analysis of Covariance (ANCOVA), with age and educational attainment as covariates, found that, compared with Remain voters, Leave voters felt significantly more positive about Brexit [$F(1,277) = 838.211, P < 0.001, \eta_p^2 = 0.752$; Remain voters: $M = 9.83, SD = 14.448$; Leave voters: $M = 78.35, SD = 22.994$] and significantly more negative about immigration [$F(1,266) = 207.857, P < 0.001, \eta_p^2 = 0.439$; Remain voters: $M = 67.88, SD = 19.717$; Leave voters: $M = 26.19, SD = 23.262$], the European Union [$F(1,275) = 493.084, P < 0.001, \eta_p^2 = 0.642$; Remain voters: $M = 75.76, SD = 18.991$; Leave voters: $M = 20.83, SD = 18.615$], and free movement of labor [$F(1,268) = 221.289, P < 0.001, \eta_p^2 = 0.452$; Remain voters: $M = 75.88, SD = 20.452$; Leave voters: $M = 33.08, SD = 24.084$]. These results and the magnitude of the effect sizes indexed by η_p^2 reveal a strong relationship between how participants voted and their attitudes toward Brexit-related issues. In particular, attitudes toward Brexit are sufficiently closely related to be acceptable as a surrogate for voting behavior.

Personality and Brexit Attitudes

Theoretical Background. In the domain of political psychology, it has been shown that social conservatives are more organized and conventional while liberals are more open-minded and novelty-seeking (9–11). We therefore measured participants’ Big Five personality traits to detect any differences between individuals with a strong versus weak sense of nationalistic identity. Furthermore, given that the notion of “taking back control” was prevalent in the Leave the European Union campaign, we measured participants’ internal locus of control, which assesses the extent to which they feel responsible for their life outcomes rather than leaving this to chance or to the influence of others (12). In line with theory on the relation between perceived personal control and affiliation with external systems (13, 14), we

hypothesized that the desire for greater control over the nation would be accompanied by a reduced sense of personal control over one's life, such that increasing collective group control would act as a compensatory mechanism for lower perceptions of personal control.

Measurement. The Big Five personality traits were assessed using the Ten-Item Personality Inventory [TIPI (15)], yielding scores on five personality dimensions: conscientiousness, emotional stability, extraversion, agreeableness, and openness to experience. Additionally, locus of control was measured using Levenson's (12) eight-item Internality scale from the Internal, Powerful Others, and Chance Scale. Items were rated on a Likert scale from 1 (strongly disagree) to 6 (strongly agree), and included items such as "my life is determined by my own actions" and "whether or not I get to be a leader depends mostly on my ability." The Cronbach's alpha was 0.78.

Results. One-way ANOVAs were conducted on personality traits measured by the TIPI (15). This showed significant differences according to voting behavior in the personality traits of conscientiousness [$F(1,288) = 6.933, P = 0.009$] and emotional stability [$F(1,294) = 4.888, P = 0.028$]. In particular, participants who voted Leave in the EU referendum reported being significantly more conscientious and emotionally stable than those who voted Remain (Fig. S4). Extraversion, agreeableness, and openness to experience were all not significantly different between groups ($P_s > 0.1$).

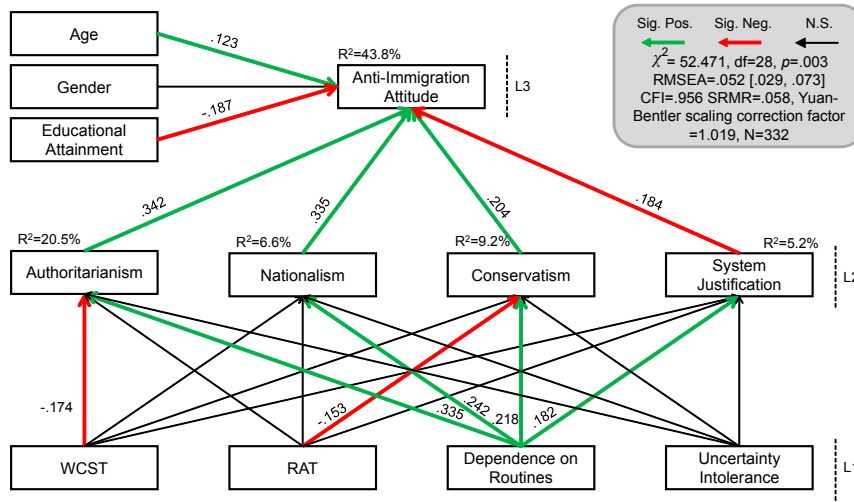
Correlations between personality traits and the nationalistic identity measures (Table S1) demonstrated that while emotionally stable individuals were more likely to endorse national superiority, individuals who rated being open to experience and agreeable were less likely to believe in the United Kingdom's

national superiority. Furthermore, individuals who were high on openness to experience tended to feel that their identity was less fused with that of the United Kingdom relative to the European Union.

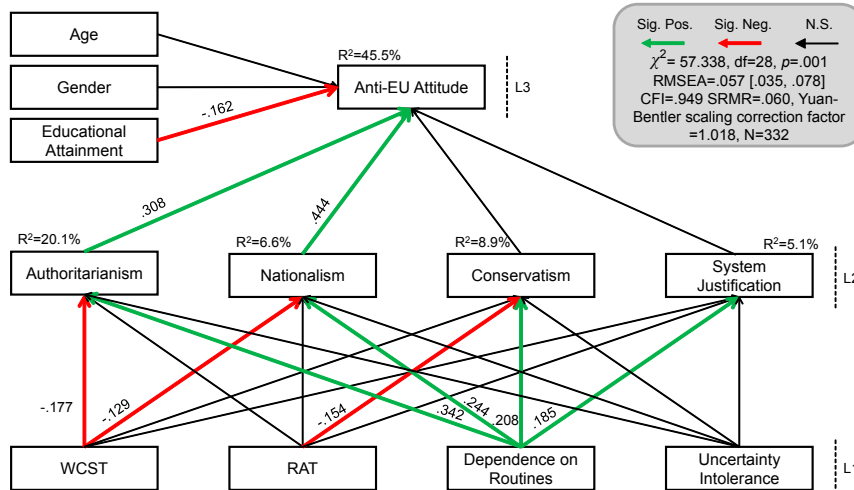
Univariate ANOVA on locus of control demonstrated a significant difference between voting groups [$F(1,294) = 8.959, P = 0.003$], such that participants who voted to leave the European Union had a more internal locus of control than participants who voted to remain (Fig. S4). Correlational analyses illustrated that individuals with a more internal locus of control tended to believe in the United Kingdom's national superiority, to justify the status quo of British society, and to feel that their identity is closely tied to the United Kingdom (Table S1).

Multivariate analyses predicting the specific Brexit attitudes, nationalistic identity fusion, and the four ideological orientation variables were also conducted in line with Gerber et al.'s (11) analysis (Table S2). A series of hierarchical linear regressions were computed, with age, gender, and educational attainment in the first step and the Big Five personality and locus of control in the second step. This revealed similar patterns to the correlational analysis in Table S1, with specific nationalistic attitudes and ideological orientations implicating different personality traits. Openness to experience positively predicted proimmigration and pro-freedom of labor movement attitudes, and negatively predicted nationalism and nationalistic identity fusion. Conscientiousness negatively predicted proimmigration attitudes, and positively predicted authoritarianism and conservatism. Emotional stability positively predicted support for Brexit and nationalism. Extraversion positively predicted support for the European Union, and agreeableness negatively predicted conservatism. Additionally, locus of control positively predicted support for Brexit, system justification, and nationalistic identity fusion.

1. Isen AM (1990) The influence of positive and negative affect on cognitive organization: Some implications for development. *Psychological and Biological Approaches to Emotion*, eds Stein NL, Leventhal B, Trabasso T (Lawrence Erlbaum, Hillsdale, NJ), pp 75–94.
2. Alexander JK, Hillier A, Smith RM, Tivarus ME, Beversdorf DQ (2007) Beta-adrenergic modulation of cognitive flexibility during stress. *J Cogn Neurosci* 19:468–478.
3. Ishizuka K, Hillier A, Beversdorf DQ (2007) Effect of the cold pressor test on memory and cognitive flexibility. *Neurocase* 13:154–157.
4. Nijstad BA, De Dreu CK, Rietzschel EF, Baas M (2010) The dual pathway to creativity model: Creative ideation as a function of flexibility and persistence. *Eur Rev Soc Psychol* 21:34–77.
5. Sidanius J, Feshbach S, Levin S, Pratto F (1997) The interface between ethnic and national attachment: Ethnic pluralism or ethnic dominance? *Public Opin Q* 61:102–133.
6. Federico CM, Golec A, Dial JL (2005) The relationship between the need for closure and support for military action against Iraq: Moderating effects of national attachment. *Pers Soc Psychol Bull* 31:621–632.
7. Ho AK, et al. (2012) Social dominance orientation: Revisiting the structure and function of a variable predicting social and political attitudes. *Pers Soc Psychol Bull* 38:583–606.
8. Kay AC, Jost JT (2003) Complementary justice: Effects of "poor but happy" and "poor but honest" stereotype exemplars on system justification and implicit activation of the justice motive. *J Pers Soc Psychol* 85:823–837.
9. Carney DR, Jost JT, Gosling SD, Potter J (2008) The secret lives of liberals and conservatives: Personality profiles, interaction styles, and the things they leave behind. *Polit Psychol* 29:807–840.
10. Caprara GV, Schwartz S, Capanna C, Vecchione M, Barbaranelli C (2006) Personality and politics: Values, traits, and political choice. *Polit Psychol* 27:1–28.
11. Gerber AS, Huber GA, Doherty D, Dowling CM, Ha SE (2010) Personality and political attitudes: Relationships across issue domains and political contexts. *Am Polit Sci Rev* 104:111–133.
12. Levenson H (1972) Distinctions within the concept of internal-external control: Development of a new scale. *Proceedings of the Annual Convention of the American Psychological Association* (Am Psychol Assoc, Honolulu, HI), 7:261–262.
13. Kay AC, Whitson JA, Gaucher D, Galinsky AD (2009) Compensatory control: Achieving order through the mind, our institutions, and the heavens. *Curr Dir Psychol Sci* 18: 264–268.
14. Landau MJ, Kay AC, Whitson JA (2015) Compensatory control and the appeal of a structured world. *Psychol Bull* 141:694–722.
15. Gosling SD, Rentfrow PJ, Swann WB (2003) A very brief measure of the Big-Five personality domains. *J Res Pers* 37:504–528.



- Kievit RA, et al.; Cam-CAN Research Team (2014) Distinct aspects of frontal lobe structure mediate age-related differences in fluid intelligence and multitasking. *Nat Commun* 5:5658.
- Kievit RA, et al. (2016) A watershed model of individual differences in fluid intelligence. *Neuropsychologia* 91:186–198.



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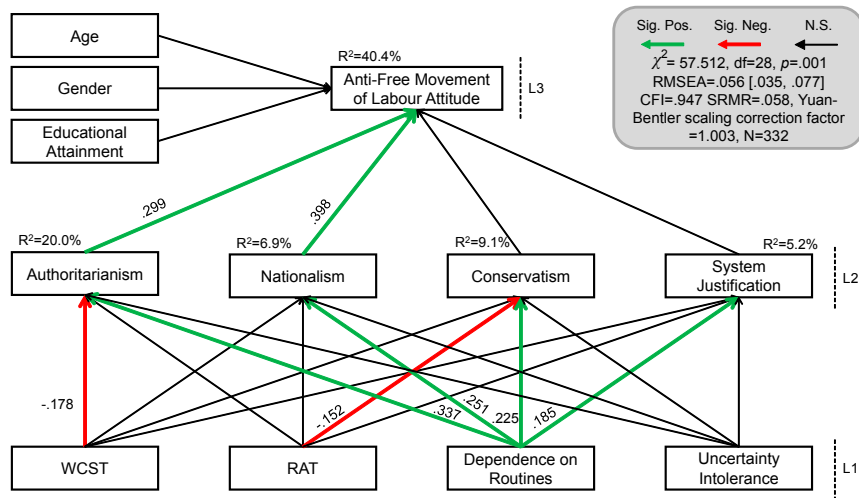


Fig. S3. Structural equation model predicting opposition to free movement of labor. All parameters shown are fully standardized. For unstandardized estimates, SEs, and confidence intervals, see Dataset S1. Significant parameter estimates are shown in green and red bolded lines. Residual covariances between psychological variables and between ideological variables are allowed, but not shown for simplicity (Dataset S1). Significance level was $P < 0.05$. Figure design was inspired by Kievit et al. (1, 2).

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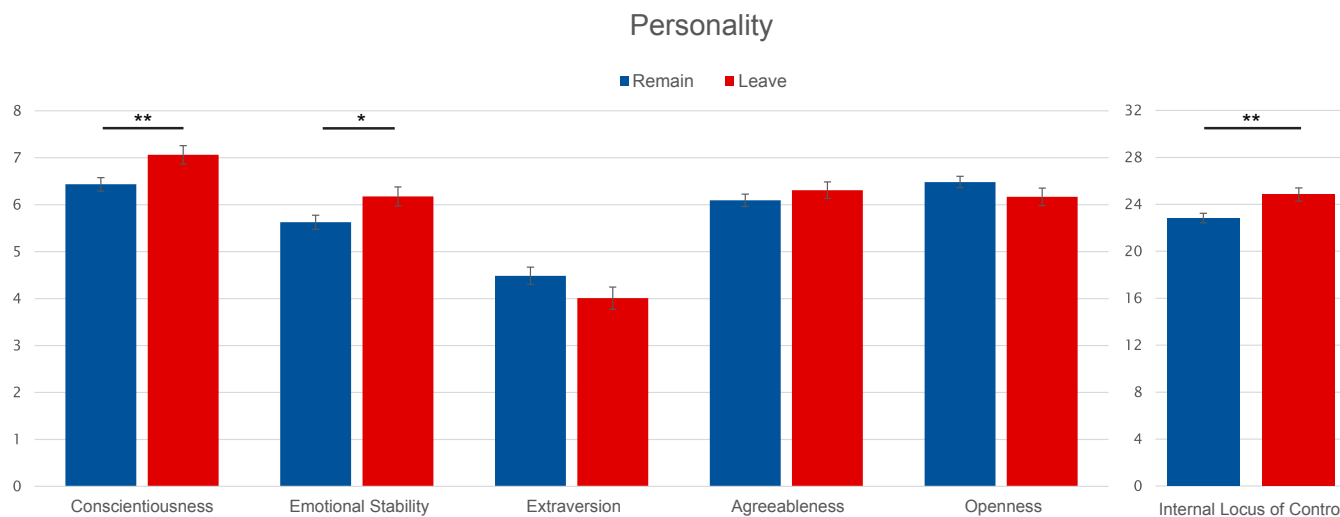


Fig. S4. Big Five personality traits and internal locus of control according to EU referendum voting behavior. ** $P < 0.01$, * $P < 0.05$; error bars reflect $1 \pm SE$.

Table S1. Correlations between measures of personality and ideological orientation and identity measures

	Personality traits					
	Locus of control	Conscientious	Emotional stability	Extraversion	Agreeableness	Openness to experience
Pro-Brexit attitude	0.190***	0.153**	0.147*	-0.073	0.046	-0.118*
Proimmigration	-0.068	-0.172**	-0.043	0.116*	-0.061	0.217***
Pro-European Union	-0.135*	-0.110	-0.082	0.134*	-0.034	0.108
Pro-free movement of labor	-0.093	-0.112	-0.080	0.089	-0.031	0.212***
Authoritarianism	0.087	0.242***	0.078	-0.069	0.142*	-0.077
Nationalism	0.209***	-0.029	0.165**	0.052	-0.162*	-0.125*
Conservatism	0.064	0.173**	0.077	0.008	-0.094	0.125*
System justification	0.385***	0.125*	0.098	0.097	-0.065	-0.069
Nationalistic identity fusion	0.192***	0.053	0.044	-0.105	0.023	-0.222***

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table S2. Direct effects of personality on nationalistic attitudes

Support for:	Step 1: Demographic				Step 2: Personality traits							R ²
	Age	Sex	Edu.	Internal locus of control	Conscientious	Emotional stability	Extraversion	Agreeableness	Openness to experience			
Brexit	0.412*	2.014	-14.49***	1.070* [0.208, 1.932]	0.491 [-2.184, 3.167]	2.608* [0.148, 5.068]	-1.312 [-3.290, 0.665]	0.125 [-2.572, 2.821]	-1.154 [-3.795, 1.487]	0.171***		
Immigration	-0.316*	-1.145	11.67***	-0.070 [-0.756, 0.616]	-2.609* [-4.717, -0.501]	-0.640 [-2.573, 1.292]	0.112 [-1.451, 1.674]	0.584 [-1.560, 2.727]	2.417* [0.331, 4.504]	0.171***		
EU	-0.233	-1.720	12.65***	-0.677 [-1.436, 0.083]	0.209 [-2.136, 2.554]	-1.496 [-3.645, 0.653]	1.844* [0.113, 3.575]	-0.805 [-3.161, 1.551]	0.395 [-1.918, 2.708]	0.139***		
Free movement of labor	-0.151	-0.053	9.34***	-0.236 [-0.940, 0.468]	0.011 [-2.213, 2.235]	-1.801 [-3.815, 0.212]	0.241 [-1.405, 1.887]	0.888 [-2.373, 2.056]	3.445** [1.248, 5.643]	0.118***		
Authoritarianism	-0.002	0.023	-0.165	0.017 [-0.019, 0.053]	0.144* [0.021, 0.267]	-0.062 [-0.173, 0.049]	-0.011 [-0.102, 0.081]	0.079 [-0.039, 0.197]	-0.051 [-0.168, 0.067]	0.080		
Nationalism	0.028	1.560	-0.812	0.165* [0.013, 0.317]	-0.408 [-0.870, 0.053]	0.475* [0.039, 0.912]	0.315 [-0.034, 0.665]	-0.304 [-0.778, 0.170]	-0.642** [-1.091, -0.156]	0.132***		
Conservatism	0.012	0.494	-0.529*	-0.002 [-0.064, 0.059]	0.252** [0.058, 0.446]	0.050 [-0.127, 0.226]	0.110 [-0.035, 0.255]	-0.197* [-0.397, 0.002]	-0.145 [-0.335, 0.045]	0.110**		
System justification	0.075	0.258	-1.090	0.812*** [0.507, 1.118]	0.076 [-0.847, 0.998]	-0.137 [-0.993, 0.719]	0.462 [-0.267, 1.192]	-0.524 [-1.455, 0.407]	-0.696 [-1.639, 0.247]	0.161***		
Nationalistic identity fusion	0.454	4.112	-20.49***	1.849* [0.245, 3.353]	-2.669 [-7.339, 2.002]	3.746 [-0.555, 8.047]	-1.656 [-5.114, 1.802]	1.450 [-3.257, 6.158]	-6.355** [-11.00, -1.710]	0.138***		

Each row reports results from a separate linear regression model; the first entry in each row is the dependent variable. Cell entries are unstandardized linear regression coefficients with the 95% confidence interval in parentheses. All models include demographic variables (age, sex, and educational attainment) as first-stage predictors in the hierarchical regression model, followed by the Big Five personality traits and locus of control included in the second stage. Edu., educational attainment. * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Other Supporting Information Files

[Dataset S1 \(XLSX\)](#)