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Representation in science and trust in scientists in the USA

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James N. Druckman[1], Katherine Ognyanova[2], Alauna Safarpour[3], Jonathan Schulman[4], Kristin Lunz Trujillo[5], Ata Aydin Uslu[6], Jon Green[7], Matthew A. Baum[8], Alexi Quintana-Mathé[6], Hong Qu[6], Roy H. Perlis[9] & David M. J. Lazer[6,10]

Scientists provide important information to the public. Whether that information influences decision-making depends on trust. In the USA, gaps in trust in scientists have been stable for 50 years: women, Black people, rural residents, religious people, less educated people and people with lower economic status express less trust than their counterparts (who are more represented among scientists). Here we probe the factors that influence trust. We find that members of the less trusting groups exhibit greater trust in scientists who share their characteristics (for example, women trust women scientists more than men scientists). They view such scientists as having more benevolence and, in most cases, more integrity. In contrast, those from high-trusting groups appear mostly indifferent about scientists' characteristics. Our results highlight how increasing the presence of underrepresented groups among scientists can increase trust. This means expanding representation across several divides—not just gender and race/ethnicity but also rurality and economic status.

Scientific information constitutes a valuable resource for societies and individuals[1,2]. Advances in science correlate with improved life outcomes[3–8]. While scientific information should not unilaterally dictate public policy or individual decisions[9], it ideally provides reliable content from which any individual or entity can draw[10]. Scientists play a key role in this process as the producers of knowledge and, in many cases, the communicators of scientific findings[11].

In the USA, citizens have long displayed high levels of trust in scientists[12], a crucial metric given that trust correlates with reliance on information such as following public health advice and recommendations about new technologies[13–16]. Alas, there also are trust gaps. These matter since those with lower trust are less likely to access and consider helpful knowledge—they are relatively disenfranchised from the public good of scientists' advice. This is individually and collectively suboptimal. Lower levels of trust also matter to scientists because they would benefit from understanding what factors vitiate confidence in them. In this paper, we identify sources of lower trust in scientists in the USA and provide insight into how to build trust. Our focus differs from much recent work that details the role of politics, partisanship and ideology in shaping trust[17,18]. Instead, we attend to how social characteristics—including gender, race/ethnicity, geography, religiosity and socio-economic status—matter.

Results

Trust in scientists

Trust exists when a person believes that another (or others) has an incentive to act in their interest: the other entity's interests encapsulate the person's interests[19]. Trust means making oneself vulnerable to

[1]Department of Political Science, University of Rochester, Rochester, NY, USA. [2]Department of Communication, Rutgers University, New Brunswick, NJ, USA. [3]Department of Political Science, Gettysburg College, Gettysburg, PA, USA. [4]Pew Research Center, Washington DC, USA. [5]Department of Political Science, Boston College, Chestnut Hill, MA, USA. [6]Network Science Institute, Northeastern University, Boston, MA, USA. [7]Department of Political Science, Duke University, Durham, NC, USA. [8]John F. Kennedy School of Government, Harvard University, Cambridge, MA, USA. [9]Center for Quantitative Health, Massachusetts General Hospital, Boston, MA, USA. [10]Institute for Quantitative Social Science, Harvard University, Cambridge, MA, USA. e-mail: jdruckma@ur.rochester.edu

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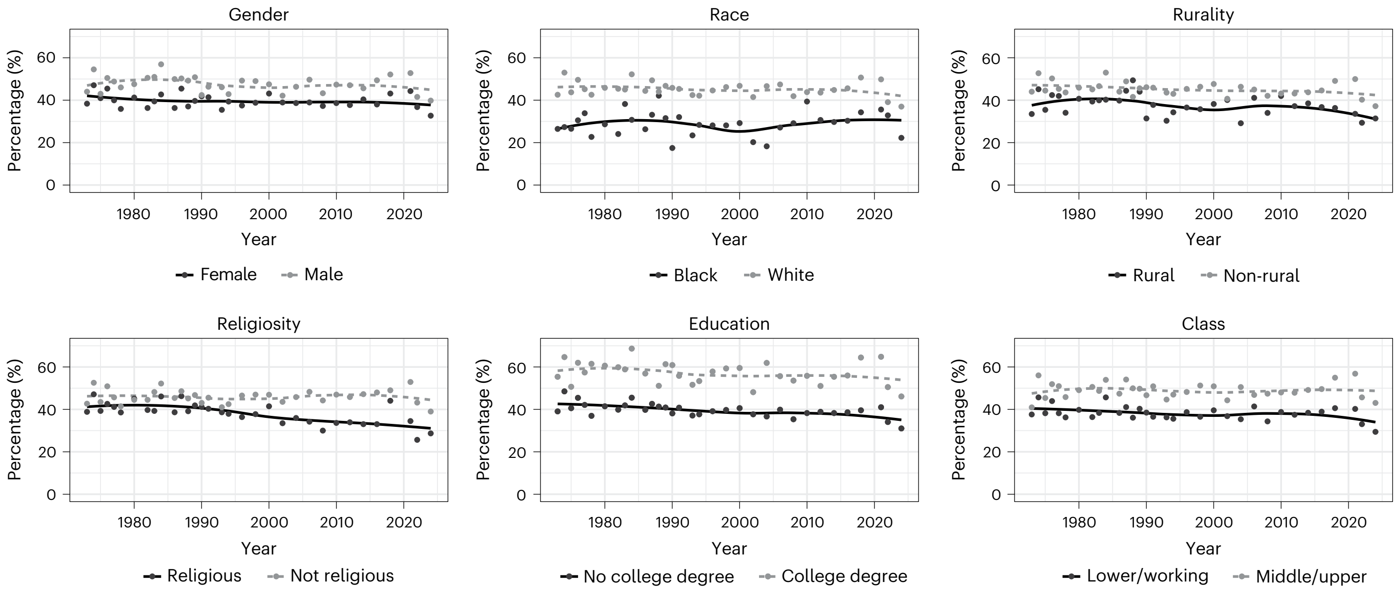

Fig. 1 | Percentage of Americans who trust scientists 'a great deal' by group. Weighted percentage of respondents from each group in a given year who stated that they had a 'great deal of confidence' in the scientific community. The answer options also included 'only some confidence' and 'hardly any confidence'. The data are from the General Social Survey. The shaded areas display 95% confidence intervals. The details are provided in Supplementary Section 1.

another's actions (for example, following their advice). An actor who gains another's trust achieves trustworthiness, regardless of whether the perceptions of trust are accurate. Trust and trustworthiness are not the same[20] but do relate to one another, as perceptions of trustworthiness influence trust[21–23]. Trustworthiness is often conceptualized as being a function of perceived competence (for example, ability and knowledge), integrity (for example, honesty) and benevolence (for example, goodwill and consideration of others' best interests)[24,25]. While we do not include it here, openness is sometimes invoked as another dimension[26].

Who trusts scientists in the USA? Existing scholarship identifies various groups that exhibit relatively less trust, including people who identify as Black[27], people from rural settings[28], those higher in religiosity[29] and those with lower socio-economic status (based on education and income)[30,31]. We explore these differences by using data from the General Social Survey that measure the amount of confidence people have in the scientific community. These data have the downsides of gauging trustworthiness rather than trust[20], not using the ideal wording (for example, 'confidence' rather than trust and 'scientific community' rather than scientists), not differentiating dimensions of trustworthiness and having limited group variables over time (for example, they only allow for the evaluation of Black and white individuals). Yet, they have the important upside of offering consistent data from high-quality probability samples for a 50-year period. Also, in their 68-country study of trust in scientists, Cologna et al.[29] found that an aggregated single trust measure reveals high reliability. Figure 1 plots trust in scientists across all the aforementioned groups, as well as gender (with the available binary indicator), which has been a variable with mixed findings in past work[29,32]. (Throughout, we use the term 'groups' in a broad sense, recognizing variation in our usage as to whether the group involves identities, belief systems, geographic locations and/or institutional experiences.)

The figure shows that women as well as Black, rural, religious, less educated and lower- or working-class individuals exhibit less confidence in the scientific community. Importantly, this has been the case for at least the past half century (Supplementary Section 1). Religion shows the most change, as the gap widened more over time. Trust in scientists in the USA may be high relative to trust in other institutions (for example, members of Congress, financial institutions or the press)[32], but it has long-standing demographic chasms even in an era of highly politicized and polarized science[33–35]. This matters since it suggests systematic differences in the extent to which members of particular groups will rely on scientific information, which can, albeit certainly not always, have life-altering implications. Indeed, it is suggestive that members of these lower-trusting groups tended to have higher mortality rates during the COVID-19 pandemic[36,37]. These gaps reveal that scientists are not serving certain populations as well as others or effectively building trust with certain constituencies.

Identifying these gaps in trust provides insight into their origins and potential antidotes. Specifically, part of the explanation likely comes from theories of social difference and trust. Previous work has shown that people exhibit more trust in others who share their characteristics[38–40], including when it comes to trust in scientists[41,42]. Along these lines, the low-trusting groups in Fig. 1 are notably underrepresented among scientists: the contemporary USA scientific workforce is approximately 66% men, 65% white, 92% from non-rural areas and 74% at least second-generation college students. The respective numbers for the general population are 50%, 59%, 80% and 56%. Moreover, more than 40% of scientists identify as atheists, dwarfing the percentage in the general population, where 28% report having no religious affiliation (which surely includes some non-atheists) (Supplementary Section 2). Scientists thus do not descriptively reflect Americans.

To evaluate whether this identity misalignment correlates with trustworthiness, we collected survey data that asked respondents to report how much they trust scientists and researchers to do what is right (a perceived trustworthiness question) and to rate the extent to which they believed scientists are different from or similar to them (Supplementary Section 3). We regressed these two outcome variables on demographic indicators as well as partisanship, ideology and conspiratorial thinking[17]. In terms of trustworthiness, our results largely echo those from the General Social Survey data, with significantly lower trustworthiness (relative to their counterparts) among women, Black and Hispanic individuals, those without a college degree, those from rural places and those who identify as lower or middle class (Fig. 2a). The respective regression coefficients, P values and confidence intervals are −0.07 ($P < 0.001$; −0.09 to −0.04), −0.13 ($P < 0.001$; −0.17 to −0.10), −0.08 ($P < 0.001$; −0.12 to −0.05), −0.10 ($P < 0.001$; −0.12 to −0.07),

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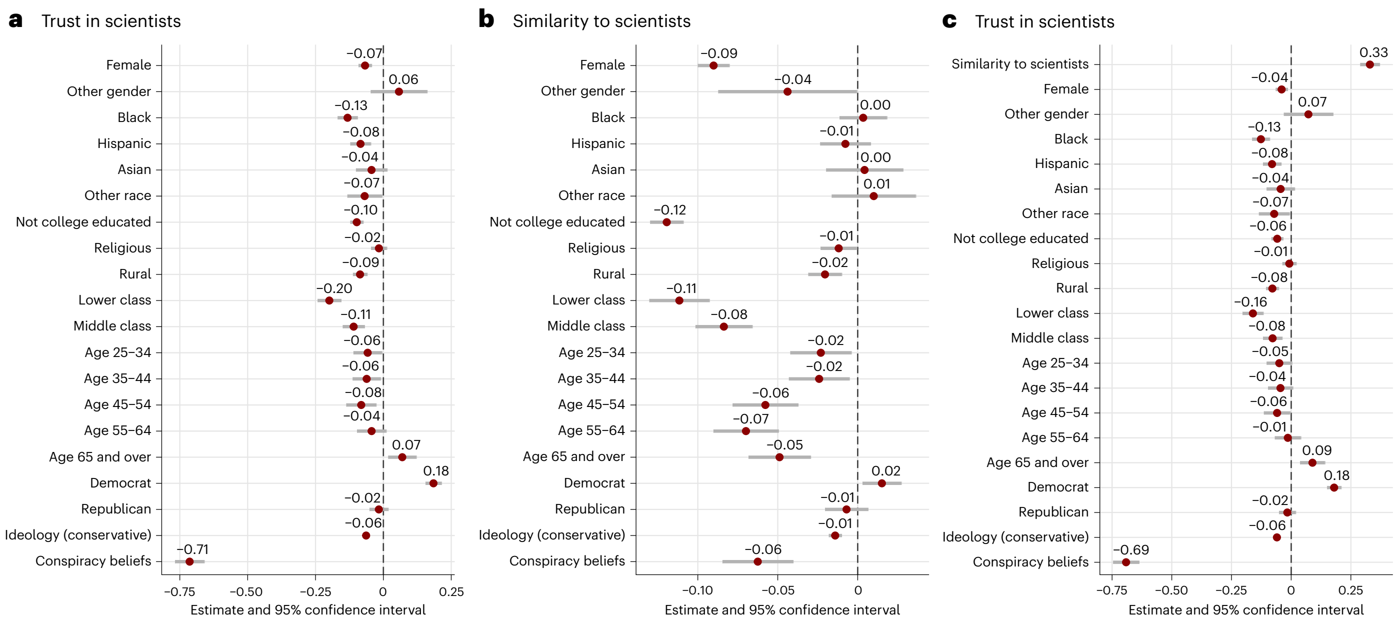

Fig. 2 | Trust in scientists and similarity to scientists. a–c, Ordinary least-squares coefficients and 95% confidence intervals for a regression of trust in scientists (which runs from 1 to 4) on respondent characteristics (**a**), a regression of similarity to scientists (which runs from 0 to 1) on respondent characteristics (**b**) and a regression of trust in scientists on similarity to scientists and respondent characteristics (**c**). The respective sample sizes for **a**–**c** are 23,217, 22,688 and 22,635. The details are provided in Supplementary Section 4.

−0.09 ($P < 0.001$; −0.11 to −0.06), −0.20 ($P < 0.001$; −0.24 to −0.16) and −0.11 ($P < 0.001$; −0.15 to −0.07) (Supplementary Section 4). The main exception is that identifying as religious is not significant, which could reflect our distinct operationalization here (that is, attendance in Fig. 1 and not being atheist/agnostic in Fig. 2) and/or that we control, in Fig. 2, for other variables including partisanship and ideology.

Except for Black and Hispanic respondents, each of these variables also reveals significant negative relationships with perceived similarity to scientists (Fig. 2b). The analogous respective statistics regarding similarity are −0.09 ($P < 0.001$; −0.10 to −0.08), 0.003 ($P = 0.650$; −0.01 to 0.02), −0.01 ($P = 0.338$; −0.02 to 0.01), −0.12 ($P < 0.001$; −0.13 to −0.11), −0.02 ($P < 0.001$; −0.03 to −0.01), −0.11 ($P < 0.001$; −0.13 to −0.09) and −0.08 ($P < 0.001$; −0.10 to −0.07) (Supplementary Section 4). Identifying as religious is also significantly negatively related to perceived similarity (−0.01; $P = 0.039$; −0.02 to −0.001). Moreover, we found that similarity itself is a strong correlate of trust in scientists (Fig. 2c) (0.33; $P < 0.001$; 0.29 to 0.37) (Supplementary Section 4). That said, the inconsistent finding regarding Black and Hispanic respondents, along with evidence that similarity does not adequately inform variation in trust among several of the groups (for example, the group coefficients, at most, only slightly reduce in the trust model when similarity is added), suggests that similarity does not fully explain the trust gaps.

As we will later discuss, it could be that similarity does not suitably envelop all the dimensions of trustworthiness. It probably captures benevolence more, and competence and integrity less. It could be that low trust among Black Americans, in particular, stems from perceptions of low integrity, reflecting a history of not being well served by science via abuse[43,44]. Scientific research also often lacks relevant data (and hence knowledge) for racial and ethnic minorities and women[45–50] and insufficient infrastructure in rural communities[51].

More generally, to the extent that social similarity correlates with trust in scientists (Fig. 2c), it probably reflects more than perceptions of descriptive representation. The disparities come, in part, from scientists' tendency to study reflections of themselves[52]. That is, social difference may make people less trusting of scientists, but those factors might make scientists less attentive to these groups as well.

Table 1 | Conjoint attributes and levels

Attribute (construct)	Levels
Gender	• Male • Female
Race/ethnicity	• White • Asian American • Black • Hispanic or Latino
Experience	• Three years in research (for scientists)/practice (for doctors) • Ten years in research (for scientists)/practice (for doctors)
Schooling (educational prestige)	• Attended a large public college and graduate school (for scientists)/medical school (for doctors) • Attended an Ivy League college and graduate school (for scientists)/medical school (for doctors)
Professional activity (religiosity)	• Regularly speaks to congregations about faith and science (for scientists)/medicine (for doctors) • Regularly speaks with civic organizations about science (for scientists)/medicine (for doctors)
Where grew up (rurality)	• A farming community where they spent much of their life • A major city where they spent much of their life
Career motivation (class)	• Motivated by hardworking parents, one of whom started a highly profitable business and the other of whom manages the family's art foundation • Motivated by hardworking parents who worked in the service industry • Motivated by hardworking parents who had to work many jobs to keep food on the table

The matched (respondent) variable for educational prestige is not having a college degree (low prestige) or having a college degree (high prestige). The matched (respondent) variable for religiosity is attending services once or twice a month or more (religious) or a few times a year or less (secular). The matched (respondent) variable for class is working/lower class ('keep food on the table'), middle class ('service industry') and upper/upper-middle class ('a highly profitable business').

Building trust in scientists

Interventions to build trust in scientists need to acknowledge that uncritical faith not only is counter to science itself but also could breed harmful consequences. When distrust stems in part from

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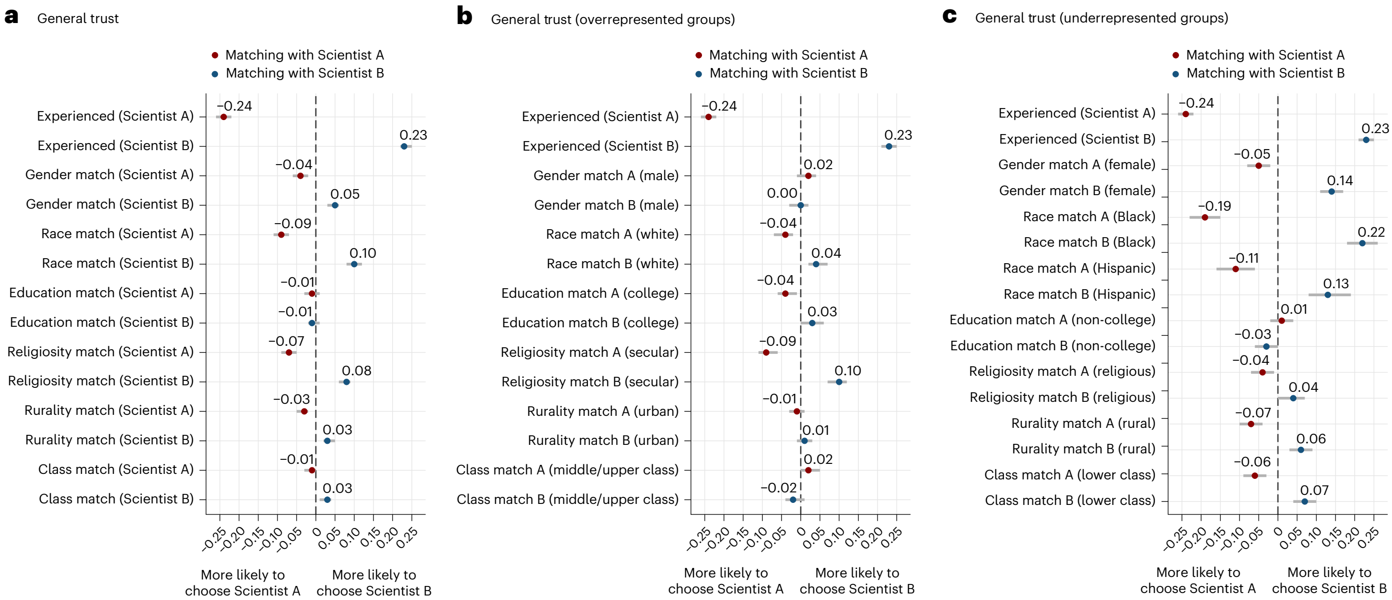

Fig. 3 | Conjoint study 1: impact of match on general trust. a–**c**, Ordinary least-squares coefficients and 95% confidence intervals for a regression of choosing Scientist B (over Scientist A) on whether the respondent's given attribute matched Scientist A ('match A') or Scientist B ('match B') (or, in the case of experience, whether Scientist A or Scientist B was experienced). Panel **a** shows the regression results with all respondents. Panel **b** shows the regression results with overrepresented groups, which include respondents from the groups noted in the figure who are overrepresented among scientists (for example, gender match A (male) indicates whether Scientist A was male for male respondents). Panel **c** shows the regression results with underrepresented groups, which include respondents from the groups noted in the figure who are underrepresented among scientists (for example, gender match A (female) indicates whether Scientist A was female for female respondents). All data come from a conjoint experiment (with a total of 12,220 observations). The details are provided in Table 2 and Supplementary Section 6.

underrepresentation, however, it raises the question of whether expanding representation can play a role in building trust. This is important given that relative exclusion from the practice of science and lower trust in scientists might preclude marginalized groups from accessing the potential benefits of science[53]. In line with our earlier argument about social similarity and difference, we sought to test whether individuals prefer to follow (that is, trust) the advice of scientists with whom they share characteristics[54]. We initially focused on trust, as in the decision to choose one source of information over the other; we did so with a conjoint survey experiment study that employed a behavioural intent measure that we take to be a reasonable proxy for actual trust decisions[55]. We later (in a subsequent section) tie this approach to trustworthiness (as measured in the surveys) and its constituent dimensions.

We implemented our study with a nationally representative sample (N = 1,120). Participants chose one of two scientists (for example, A or B) whose advice they would follow for taking a vaccine or one of two doctors (for example, A or B) they would prefer to have as their primary care physician (Supplementary Section 5). We included scientist and physician choices for stimulus sampling reasons[56], noting that the legitimacy of medicine depends on the credibility of science[57]. We did not predict differences between the two scenarios and computed our power calculations on the assumption of evaluating them together. Henceforth, we use only the term 'scientists' for efficiency.

Each scientist was described along seven dimensions: gender (male or female), race/ethnicity (white, Black, Hispanic or Latino, or Asian American), experience (low or high), educational prestige (public institution or Ivy League), religiosity (for example, speaks to religious organizations or to civic organizations), rural or urban upbringing, and class background (lower, middle or upper). We included educational prestige and class background to capture socio-economic profiles. Experience provides a benchmark to assess the impact of demographic characteristics. Table 1 provides a list of all attributes and their levels. In Supplementary Section 5, we discuss the operational choices, the two most challenging of which were education (prestige) and religiosity. Scientists are, by definition, educated, which is why we focused on prestige in terms of attending public schools or Ivy League schools. For religiosity, we used a signal—via civic activities—that the scientist speaks to congregations, which would suggest the scientist does not see a fundamental divide between science and religion. Prior work suggests that signalling religion in some manner can promote trust in scientists among religious individuals[41,58].

In practice, a respondent would receive a table that described Scientist A's (randomly drawn) characteristics and Scientist B's (randomly drawn) characteristics. The information for Scientist A might describe them as male, white, high experience, Ivy League educated, religious, rural and middle class. Scientist B might be portrayed as male, Black, low experience, Ivy League educated, non-religious, urban and middle class. The precise attributes for each scientist were probabilistically determined and could be the same (or not) for A and B (in the example, A and B are both male, but A is white and B is Black). We then computed whether each demographic attribute was a match or not a match for the respondent. For instance, if the respondent were a Black, religious male, then we would code Scientist A as being a gender and religiosity match but not a race/ethnicity match; Scientist B would be a gender and race/ethnicity match but not a religiosity match. The one exception was experience, which was not a variable that was matched; rather, it was simply an indicator (0/1) of whether the scientist was more experienced. Our interest is in whether the likelihood of choosing Scientist A or Scientist B increases in the presence of a given demographic match (Supplementary Section 5).

Figure 3a displays the changed probability of choosing Scientist B or Scientist A given a particular match with A or with B (relative to a non-match). The precise regression outcome coded choosing B as equal to 1 and choosing A as equal to 0. So, for example, when Scientist A shared the respondent's gender (for example, both were female), the probability of choosing A increased, all else constant, by 0.04 (the regression coefficient is negative given the coding of the dependent

Table 2 | Statistics for conjoint study 1: impact of match on trust

(a) General trust (Fig. 3a)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.24	0.01	−0.26 to −0.22	<0.001
Experienced B	0.23	0.01	0.22 to 0.25	<0.001
Gender match A	−0.04	0.01	−0.06 to −0.02	<0.001
Gender match B	0.05	0.01	0.03 to 0.06	<0.001
Race/ethnicity match A	−0.09	0.01	−0.11 to −0.07	<0.001
Race/ethnicity match B	0.1	0.01	0.08 to 0.12	<0.001
Education match A	−0.01	0.01	−0.03 to 0.01	0.208
Education match B	−0.01	0.01	−0.02 to 0.01	0.393
Religiosity match A	−0.07	0.01	−0.09 to −0.05	<0.001
Religiosity match B	0.08	0.01	0.06 to 0.09	<0.001
Rurality match A	−0.03	0.01	−0.05 to −0.02	<0.001
Rurality match B	0.03	0.01	0.02 to 0.05	<0.001
Class match A	−0.01	0.01	−0.03 to 0	0.136
Class match B	0.03	0.01	0.01 to 0.04	0.005
(b) General trust (Fig. 3b)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.24	0.01	−0.26 to −0.22	<0.001
Experienced B	0.23	0.01	0.21 to 0.25	<0.001
Gender match A (male)	0.02	0.01	−0.01 to 0.04	0.17
Gender match B (male)	0	0.01	−0.03 to 0.02	0.93
Race/ethnicity match A (white)	−0.04	0.01	−0.07 to −0.02	<0.001
Race/ethnicity match B (white)	0.04	0.01	0.02 to 0.07	0.002
Education match A (college)	−0.04	0.01	−0.06 to −0.01	0.008
Education match B (college)	0.03	0.01	0 to 0.06	0.024
Religiosity match A (secular)	−0.09	0.01	−0.11 to −0.06	<0.001
Religiosity match B (secular)	0.1	0.01	0.07 to 0.12	<0.001
Rurality match A (urban)	−0.01	0.01	−0.03 to 0.01	0.22
Rurality match B (urban)	0.01	0.01	−0.01 to 0.03	0.19
Class match A (middle/upper class)	0.02	0.01	0 to 0.05	0.03
Class match B (middle/upper class)	−0.02	0.01	−0.04 to 0.01	0.15
(c) General trust (Fig. 3c)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.24	0.01	−0.26 to −0.22	<0.001
Experienced B	0.23	0.01	0.21 to 0.25	<0.001
Gender match A (female)	−0.05	0.02	−0.08 to −0.02	<0.001
Gender match B (female)	0.14	0.02	0.11 to 0.17	<0.001
Race/ethnicity match A (Black)	−0.19	0.02	−0.23 to −0.15	<0.001
Race/ethnicity match B (Black)	0.22	0.02	0.18 to 0.26	<0.001
Race/ethnicity match A (Hispanic)	−0.11	0.03	−0.16 to −0.06	<0.001
Race/ethnicity match B (Hispanic)	0.13	0.03	0.08 to 0.19	<0.001
Education match A (non-college)	0.01	0.02	−0.02 to 0.04	0.749
Education match B (non-college)	−0.03	0.02	−0.06 to 0	0.026
Religiosity match A (religious)	−0.04	0.02	−0.07 to −0.01	0.013
Religiosity match B (religious)	0.04	0.02	0 to 0.07	0.033
Rurality match A (rural)	−0.07	0.02	−0.1 to −0.04	<0.001
Rurality match B (rural)	0.06	0.02	0.03 to 0.09	<0.001
Class match A (lower class)	−0.06	0.02	−0.09 to −0.03	<0.001
Class match B (lower class)	0.07	0.02	0.04 to 0.1	<0.001

The coefficients come from regressions (Supplementary Section 6). All standard errors are clustered. The *P* values are two-sided based on *t*-tests and not corrected for multiple comparisons. The *P* values in **c** are tests of significance relative to the overrepresented group, other than for experienced, where the relevant null is 0.

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variable, so it is −0.04 ($P < 0.001$; −0.06 to −0.02)). Analogously, when there is a gender match for Scientist B, the probability of opting for B increased, all else constant, by 0.05 ($P < 0.001$; 0.03 to 0.06). Across variables, the probabilities are similar for A and B because, all else constant, nothing else varied between the choices. Table 2a provides the statistics underlying the figure.

Several findings stand out. First, being experienced dwarfs any single group attribute, with respondents strongly preferring the more experienced option, increasing the probability of a given choice by roughly 23.5 percentage points. Second, the results reveal that a demographic match (for example, a female scientist for a female respondent or a scientist who grew up in a rural setting for a rural respondent) affects the probability of selecting the scientist. This holds for gender (roughly a 4.5-percentage-point change), race/ethnicity (roughly a 9.5-percentage-point change), religiosity (roughly a 7.5-percentage-point change) and rurality (roughly a 3-percentage-point change). Educational prestige and class do not exhibit consistent meaningful effects. The group effects are small relative to the effect of being experienced, but they build on one another; on average, each additional match increases the likelihood of a choice by about 4 percentage points, meaning that if all the statistically significant attributes match, it boosts the likelihood of that choice by roughly 24.5 percentage points, virtually equalling the effect of being experienced (Supplementary Section 6). Third, if the two choices are both matches on a given attribute (for example, race/ethnicity), the impact of a match on that attribute cancels out, which is sensible.

Figure 3b shows the influence of matches for those who are overrepresented in science on the given attribute. For instance, for gender, it displays the impact of the option (A or B) being male for male respondents. For race/ethnicity, the figure reports the impact of a racial match for white respondents (and for the other attributes—college-educated, non-religious or secular, urban, and middle or upper class). Figure 3c shows the effects for those underrepresented among scientists, such as when the option (A or B) is Black for Black respondents, and so on, as noted in the figure. Table 2b,c provides the statistics underlying the figures.

The results make it clear that women, Black, Hispanic or Latino, rural and lower-class respondents displayed significantly stronger preferences for a scientist who matched their acute respective characteristic than their better-represented counterparts, who, in fact, are largely indifferent to those features[59]. Indeed, the overrepresented group result suggests there exists little negative reaction (that is, lower trust) from having more diverse choices along those dimensions. That said, those from overrepresented groups relatively prioritize the level of religiosity and educational prestige (and seemingly care about race/ethnicity). Non-religious respondents strongly prefer a non-religious choice to a greater extent than religious individuals prefer a choice that signals religiosity. Also, educated individuals show a match effect, whereas less educated individuals do not. Experience has nearly identical effects for respondents from under- and overrepresented groups. Overall, those underrepresented in science in terms of gender, race/ethnicity, rurality and class prefer scientists who share their backgrounds (more than their overrepresented counterparts).

Expanding representation can also increase general trust in scientists. In the experiment, respondents reported their general trust in scientists on a scale from 0 to 100 prior to choosing between the scientists, an exercise they did ten times (that is, they received ten profiles and made ten choices, and the results in Fig. 3 include each of those choices). They were then asked about their general trust after the scenarios. We found that as the number of precise matches received across the ten choices increased, so did general trust in scientists—this is particularly the case for female, Black and religious respondents. For example, as female respondents received more female scientist choices over the course of the experiment, their overall trust increased[60]. The same is true for Black respondents (for matches regarding race) and religious respondents (for matches regarding religiosity) (Supplementary Section 7). This occurs for trust in scientists but not for trust in pharmaceutical companies, which served as a placebo. We presume this is a temporary priming effect[61]; however, with longer-term changes, such perceptions could become chronically accessible and elevate trust in scientists in a more durable fashion.

Dimensions of trustworthiness

The results thus far raise two questions. First, do the intended behaviour data from the conjoint experiment align with the survey measures of trustworthiness? Addressing this question will provide insight into whether diversifying the scientific workforce maps onto reported trustworthiness, an important institutional signal[12]. Second, which dimensions of trustworthiness matter? Relatedly, how do we square the null result regarding Black respondents in our similarity data with their high levels of concordance in the conjoint data (a finding consistent with prior work)[62–64]? We addressed these questions by replicating the conjoint experiment, this time randomly assigning respondents to one of five different outcome measures: (1) choose which scientist's advice to follow (as in the prior study; that is, general trust), (2) choose the more trustworthy scientist, (3) choose the scientist who has more integrity, (4) choose the more benevolent scientist (that is, considerate of others', including the respondent's, interests) and (5) choose the more competent scientist. This set-up enables us to provide insight into dimensions of trustworthiness, although it does not allow for direct documentation of mediational relationships (Supplementary Sections 9 and 10).

We present the results, differentiating the over- and underrepresented groups for each measure in three ways (see Supplementary Section 10 for an analysis with all respondents merged). In Fig. 4, we display the effects for each attribute for each outcome measure, with Table 3 providing the statistics underlying the figure (also see Supplementary Section 10). To facilitate discussion, given the large number of relationships presented in the figures and tables, Table 4 summarizes the findings—for both the overrepresented and underrepresented groups—by reporting the dimension of trust for which a given attribute is statistically significant at the 0.05 level in the expected directions for both A and B. For instance, the second row of Table 4 displays the dimensions for which a gender match is significant, for overrepresented (males) and underrepresented (females) groups. It shows that the gender match is not significant for any outcome/dimension for overrepresented respondents, but it is significant for underrepresented

Fig. 4 | Conjoint study 2: impact of match on general trust and trust dimensions. a–j, Ordinary least-squares coefficients and 95% intervals for a regression of choosing Scientist B (over Scientist A) on whether the respondent's given attribute matched Scientist A ('match A') or Scientist B ('match B') (or, in the case of experience, whether Scientist A or Scientist B was experienced) for overrepresented groups of respondents and underrepresented groups of respondents. Overrepresented groups include respondents from the group noted in the figure who are overrepresented among scientists (for example, gender match A (male) indicates whether Scientist A was male for male respondents). Underrepresented groups include respondents from the group noted in the figure who are underrepresented among scientists (for example, gender match A (female) indicates whether Scientist A was female for female respondents). Panels **a** and **b** show the regression results for general trust, **c** and **d** show the regression results for trustworthiness, **e** and **f** show the regression results for integrity, **g** and **h** show the regression results for benevolence, and **i** and **j** show the regression results for competence. All data come from a conjoint experiment (with respective observations for general trust, trustworthiness, integrity, benevolence and competence of 6,070, 6,190, 5,860, 5,980 and 6,210). The details are provided in Table 3 and Supplementary Section 10.

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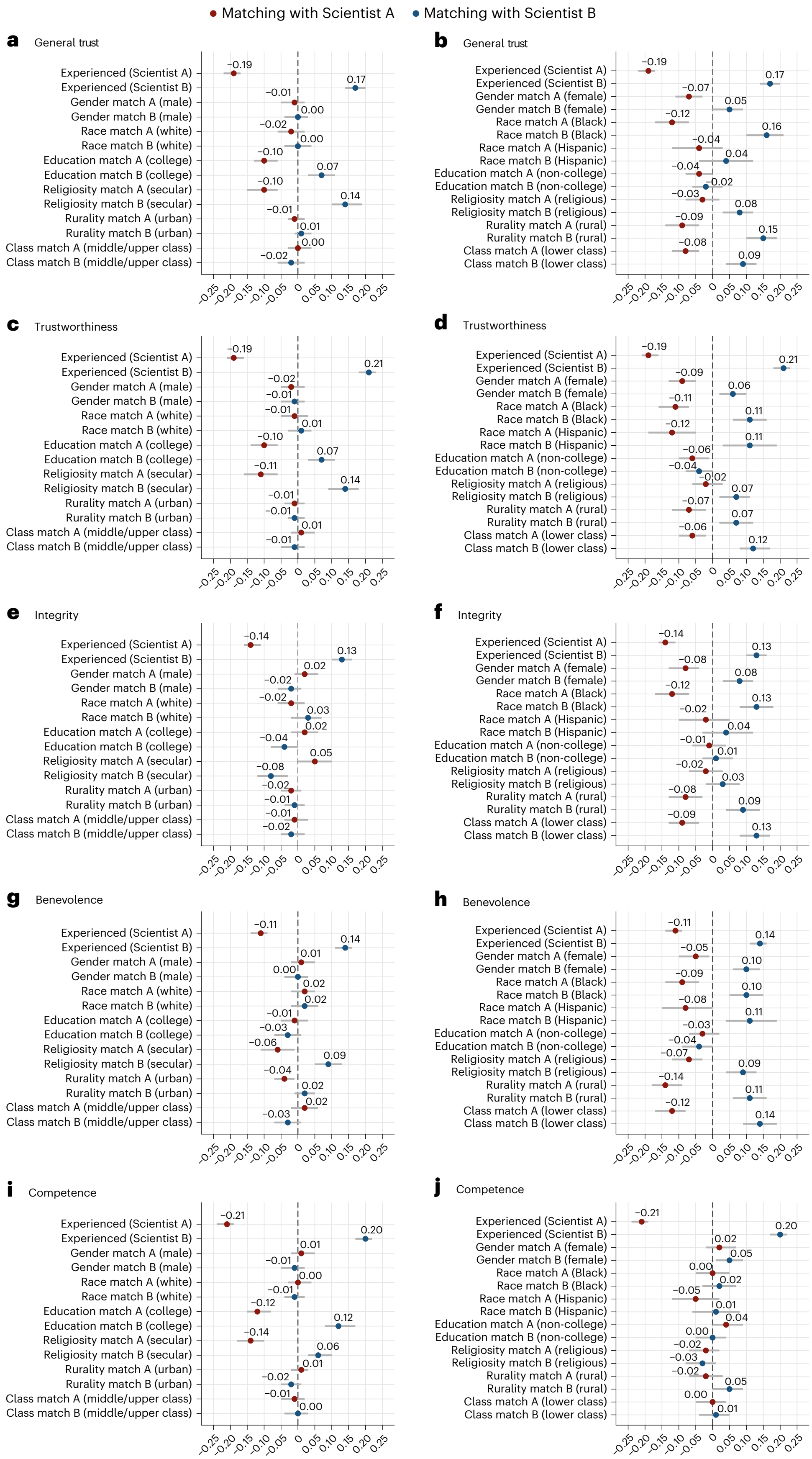

Table 3 | Statistics for conjoint study 2: impact of match on trust and trust dimensions

(a) General trust (Fig. 4a)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.19	0.01	−0.22 to −0.17	<0.001
Experienced B	0.17	0.01	0.14 to 0.20	<0.001
Gender match A (male)	−0.01	0.02	−0.05 to 0.02	0.46
Gender match B (male)	−0.00	0.02	−0.04 to 0.03	0.82
Race/ethnicity match A (white)	−0.02	0.02	−0.06 to 0.02	0.40
Race/ethnicity match B (white)	0.00	0.02	−0.04 to 0.04	0.97
Education match A (college)	−0.10	0.02	−0.13 to −0.06	<0.001
Education match B (college)	0.07	0.02	0.03 to 0.11	<0.001
Religiosity match A (secular)	−0.10	0.02	−0.15 to −0.06	<0.001
Religiosity match B (secular)	0.14	0.02	0.10 to 0.19	<0.001
Rurality match A (urban)	−0.01	0.01	−0.03 to 0.02	0.69
Rurality match B (urban)	0.01	0.01	−0.01 to 0.04	0.35
Class match A (middle/upper class)	0.00	0.02	−0.03 to 0.04	0.94
Class match B (middle/upper class)	−0.02	0.02	−0.06 to 0.02	0.32
(b) General trust (Fig. 4b)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.19	0.01	−0.22 to −0.17	<0.001
Experienced B	0.17	0.01	0.14 to 0.20	<0.001
Gender match A (female)	−0.07	0.02	−0.11 to −0.03	0.001
Gender match B (female)	0.05	0.02	0.00 to 0.09	0.03
Race/ethnicity match A (Black)	−0.12	0.03	−0.17 to −0.07	<0.001
Race/ethnicity match B (Black)	0.16	0.03	0.10 to 0.21	<0.001
Race/ethnicity match A (Hispanic)	−0.04	0.04	−0.12 to 0.03	0.06
Race/ethnicity match B (Hispanic)	0.04	0.04	−0.04 to 0.12	0.83
Education match A (non-college)	−0.04	0.02	−0.08 to 0.00	0.31
Education match B (non-college)	−0.02	0.02	−0.06 to 0.03	0.95
Religiosity match A (religious)	−0.03	0.02	−0.08 to 0.02	0.07
Religiosity match B (religious)	0.08	0.02	0.03 to 0.12	0.02
Rurality match A (rural)	−0.09	0.03	−0.14 to −0.04	<0.001
Rurality match B (rural)	0.15	0.02	0.10 to 0.19	<0.001
Class match A (lower class)	−0.08	0.02	−0.12 to −0.04	<0.001
Class match B (lower class)	0.09	0.02	0.04 to 0.13	<0.001
(c) Trustworthiness (Fig. 4c)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.19	0.01	−0.21 to −0.16	<0.001
Experienced B	0.21	0.01	0.18 to 0.23	<0.001
Gender match A (male)	−0.02	0.02	−0.05 to 0.02	0.39
Gender match B (male)	−0.01	0.02	−0.05 to 0.02	0.47
Race/ethnicity match A (white)	−0.01	0.02	−0.05 to 0.03	0.59
Race/ethnicity match B (white)	0.01	0.02	−0.03 to 0.04	0.73
Education match A (college)	−0.10	0.02	−0.14 to −0.06	<0.001
Education match B (college)	0.07	0.02	0.03 to 0.11	<0.001
Religiosity match A (secular)	−0.11	0.02	−0.16 to −0.06	<0.001
Religiosity match B (secular)	0.14	0.02	0.09 to 0.18	<0.001
Rurality match A (urban)	−0.01	0.01	−0.04 to 0.02	0.65
Rurality match B (urban)	−0.01	0.01	−0.03 to 0.02	0.73
Class match A (middle/upper class)	0.01	0.02	−0.02 to 0.05	0.50

Table 3 (continued) | Statistics for conjoint study 2: impact of match on trust and trust dimensions

(c) Trustworthiness (Fig. 4c)				
	Coefficient	**s.e.**	**95% CI**	***P***
Class match B (middle/upper class)	−0.01	0.02	−0.05 to 0.02	0.52
(d) Trustworthiness (Fig. 4d)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.19	0.01	−0.21 to −0.16	<0.001
Experienced B	0.21	0.01	0.18 to 0.23	<0.001
Gender match A (female)	−0.09	0.02	−0.13 to −0.05	0.001
Gender match B (female)	0.06	0.02	0.02 to 0.10	<0.001
Race/ethnicity match A (Black)	−0.11	0.02	−0.16 to −0.07	<0.001
Race/ethnicity match B (Black)	0.11	0.03	0.06 to 0.16	<0.001
Race/ethnicity match A (Hispanic)	−0.12	0.04	−0.19 to −0.05	0.002
Race/ethnicity match B (Hispanic)	0.11	0.04	0.03 to 0.19	0.004
Education match A (non-college)	−0.06	0.02	−0.10 to −0.01	0.70
Education match B (non-college)	−0.04	0.02	−0.08 to 0.00	0.87
Religiosity match A (religious)	−0.02	0.02	−0.06 to 0.03	0.05
Religiosity match B (religious)	0.07	0.02	0.02 to 0.11	0.08
Rurality match A (rural)	−0.07	0.02	−0.12 to −0.02	0.002
Rurality match B (rural)	0.07	0.03	0.02 to 0.12	0.01
Class match A (lower class)	−0.06	0.02	−0.10 to −0.02	<0.001
Class match B (lower class)	0.12	0.02	0.08 to 0.17	<0.001
(e) Integrity (Fig. 4e)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.14	0.01	−0.16 to −0.11	<0.001
Experienced B	0.13	0.01	0.10 to 0.16	<0.001
Gender match A (male)	0.02	0.02	−0.01 to 0.06	0.25
Gender match B (male)	−0.02	0.02	−0.06 to 0.01	0.23
Race/ethnicity match A (white)	−0.02	0.02	−0.06 to 0.02	0.34
Race/ethnicity match B (white)	0.03	0.02	−0.02 to 0.07	0.22
Education match A (college)	0.02	0.02	−0.02 to 0.06	0.34
Education match B (college)	−0.04	0.02	−0.08 to 0.00	0.07
Religiosity match A (secular)	0.05	0.02	0.00 to 0.10	0.04
Religiosity match B (secular)	−0.08	0.02	−0.12 to −0.03	<0.001
Rurality match A (urban)	−0.02	0.02	−0.05 to 0.01	0.31
Rurality match B (urban)	−0.01	0.02	−0.04 to 0.02	0.40
Class match A (middle/upper class)	−0.01	0.02	−0.04 to 0.03	0.79
Class match B (middle/upper class)	−0.02	0.02	−0.05 to 0.02	0.43
(f) Integrity (Fig. 4f)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.14	0.01	−0.16 to −0.11	<0.001
Experienced B	0.13	0.01	0.10 to 0.16	<0.001
Gender match A (female)	−0.08	0.02	−0.13 to −0.04	<0.001
Gender match B (female)	0.08	0.02	0.03 to 0.12	0.01
Race/ethnicity match A (Black)	−0.12	0.03	−0.17 to −0.07	<0.001
Race/ethnicity match B (Black)	0.13	0.03	0.08 to 0.18	<0.001
Race/ethnicity match A (Hispanic)	−0.02	0.04	−0.10 to 0.05	0.52
Race/ethnicity match B (Hispanic)	0.04	0.04	−0.03 to 0.12	0.29
Education match A (non-college)	−0.01	0.02	−0.06 to 0.04	0.37
Education match B (non-college)	0.01	0.02	−0.03 to 0.06	0.94

Table 3 (continued) | Statistics for conjoint study 2: impact of match on trust and trust dimensions

(f) Integrity (Fig. 4f)				
	Coefficient	**s.e.**	**95% CI**	***P***
Religiosity match A (religious)	−0.02	0.03	−0.07 to 0.03	0.20
Religiosity match B (religious)	0.03	0.03	−0.02 to 0.08	0.46
Rurality match A (rural)	−0.08	0.03	−0.13 to −0.03	0.002
Rurality match B (rural)	0.09	0.03	0.04 to 0.14	<0.001
Class match A (lower class)	−0.09	0.02	−0.13 to −0.04	<0.001
Class match B (lower class)	0.13	0.02	0.08 to 0.17	<0.001
(g) Benevolence (Fig. 4g)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.11	0.01	−0.14 to −0.09	<0.001
Experienced B	0.14	0.01	0.11 to 0.16	<0.001
Gender match A (male)	0.01	0.02	−0.02 to 0.05	0.42
Gender match B (male)	−0.00	0.02	−0.04 to 0.03	0.86
Race/ethnicity match A (white)	0.02	0.02	−0.02 to 0.05	0.34
Race/ethnicity match B (white)	0.02	0.02	−0.02 to 0.06	0.27
Education match A (college)	−0.01	0.02	−0.05 to 0.03	0.59
Education match B (college)	−0.03	0.02	−0.07 to 0.01	0.11
Religiosity match A (secular)	−0.06	0.02	−0.11 to −0.01	0.01
Religiosity match B (secular)	0.09	0.02	0.05 to 0.13	<0.001
Rurality match A (urban)	−0.04	0.01	−0.07 to −0.01	<0.001
Rurality match B (urban)	0.02	0.01	−0.01 to 0.05	0.11
Class match A (middle/upper class)	0.02	0.02	−0.02 to 0.06	0.38
Class match B (middle/upper class)	−0.03	0.02	−0.07 to 0.01	0.09
(h) Benevolence (Fig. 4h)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.11	0.01	−0.14 to −0.09	<0.001
Experienced B	0.14	0.01	0.11 to 0.16	<0.001
Gender match A (female)	−0.05	0.02	−0.10 to −0.01	<0.001
Gender match B (female)	0.10	0.02	0.06 to 0.14	<0.001
Race/ethnicity match A (Black)	−0.09	0.03	−0.14 to −0.04	<0.001
Race/ethnicity match B (Black)	0.10	0.03	0.05 to 0.15	<0.001
Race/ethnicity match A (Hispanic)	−0.08	0.04	−0.15 to 0.00	0.01
Race/ethnicity match B (Hispanic)	0.11	0.04	0.04 to 0.19	0.02
Education match A (non-college)	−0.03	0.02	−0.07 to 0.02	0.28
Education match B (non-college)	−0.04	0.02	−0.09 to 0.00	0.74
Religiosity match A (religious)	−0.07	0.02	−0.12 to −0.03	0.002
Religiosity match B (religious)	0.09	0.02	0.04 to 0.13	<0.001
Rurality match A (rural)	−0.14	0.02	−0.18 to −0.09	<0.001
Rurality match B (rural)	0.11	0.02	0.06 to 0.16	<0.001
Class match A (lower class)	−0.12	0.02	−0.17 to −0.08	<0.001
Class match B (lower class)	0.14	0.02	0.09 to 0.19	<0.001
(i) Competence (Fig. 4i)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.21	0.01	−0.24 to −0.19	<0.001
Experienced B	0.20	0.01	0.17 to 0.22	<0.001
Gender match A (male)	0.01	0.02	−0.02 to 0.05	0.46
Gender match B (male)	−0.01	0.02	−0.05 to 0.02	0.47
Race/ethnicity match A (white)	0.00	0.02	−0.03 to 0.04	0.84

Table 3 (continued) | Statistics for conjoint study 2: impact of match on trust and trust dimensions

(i) Competence (Fig. 4i)				
	Coefficient	s.e.	95% CI	P
Race/ethnicity match B (white)	−0.01	0.02	−0.04 to 0.02	0.55
Education match A (college)	−0.12	0.02	−0.15 to −0.08	<0.001
Education match B (college)	0.12	0.02	0.08 to 0.17	<0.001
Religiosity match A (secular)	−0.14	0.02	−0.18 to −0.10	<0.001
Religiosity match B (secular)	0.06	0.02	0.03 to 0.10	<0.001
Rurality match A (urban)	0.01	0.01	−0.02 to 0.03	0.66
Rurality match B (urban)	−0.02	0.02	−0.05 to 0.01	0.23
Class match A (middle/upper class)	−0.01	0.02	−0.05 to 0.02	0.50
Class match B (middle/upper class)	0.00	0.02	−0.04 to 0.03	0.92
(j) Competence (Fig. 4j)				
	Coefficient	**s.e.**	**95% CI**	***P***
Experienced A	−0.21	0.01	−0.24 to −0.19	<0.001
Experienced B	0.20	0.01	0.17 to 0.22	<0.001
Gender match A (female)	0.02	0.02	−0.02 to 0.07	0.53
Gender match B (female)	0.05	0.02	0.01 to 0.09	0.52
Race/ethnicity match A (Black)	0.00	0.03	−0.05 to 0.05	0.51
Race/ethnicity match B (Black)	0.02	0.03	−0.03 to 0.07	0.86
Race/ethnicity match A (Hispanic)	−0.05	0.03	−0.12 to 0.02	0.50
Race/ethnicity match B (Hispanic)	0.01	0.04	−0.06 to 0.08	0.32
Education match A (non-college)	0.04	0.02	0.00 to 0.09	0.61
Education match B (non-college)	−0.00	0.02	−0.05 to 0.04	0.10
Religiosity match A (religious)	−0.02	0.02	−0.07 to 0.02	0.85
Religiosity match B (religious)	−0.03	0.02	−0.08 to 0.01	0.80
Rurality match A (rural)	−0.02	0.02	−0.07 to 0.03	0.07
Rurality match B (rural)	0.05	0.02	0.00 to 0.09	0.29
Class match A (lower class)	0.00	0.02	−0.05 to 0.04	0.83
Class match B (lower class)	0.01	0.02	−0.04 to 0.05	0.55

The coefficients come from regressions (Supplementary Section 10). All standard errors are clustered. The *P* values are two-sided based on *t*-tests and not corrected for multiple comparisons. The *P* values in **b**, **d**, **f**, **h** and **j** are tests of significance relative to the overrepresented group, other than for experienced, where the relevant null is 0.

respondents (females) for general trust, trustworthiness, integrity and benevolence.

We highlight five findings. First, we found that having more experience increases scores on all dimensions for both overrepresented and underrepresented groups; this is made clear in the first row of Table 4, which lists each dimension for the experience attribute. Figure 4 shows that being experienced has a larger impact on competence than on integrity and benevolence. (For the remainder of the discussion, we put aside the experience result.) Second, we largely replicated the first experiment: the general trust results hold for overrepresented respondents regarding education (highly educated) and religiosity (non-religious), and for underrepresented respondents regarding gender (women), race (Black), rurality (rural) and class (lower-class). They are less consistent for overrepresented respondents regarding race/ethnicity (white) and for underrepresented respondents regarding religiosity (religious), as well as race/ethnicity for Hispanic or Latino respondents. Variability in coefficients across match A and match B, shown in Fig. 4, on the same attribute may reflect lower statistical power than in the prior study. Third, we found very similar results when respondents chose which scientist they viewed as more trustworthy (in Table 4, 'general trust' and 'trustworthiness' occupy the same cells; see Fig. 4a–d). This suggests an alignment between trust via choosing an information source and relative trustworthiness evaluations (that is, survey measures).

Fourth, we found that members of all underrepresented groups that displayed a general trust matching effect also perceived those who share their characteristics as having more integrity and being more benevolent (in Table 4, for underrepresented respondents, cells with 'general trust' always include 'integrity' and 'benevolence'; see Fig. 4e–h). This includes women, Black, rural and lower-class respondents. Religious respondents also perceived matches as being more benevolent. While we cannot directly explain the null effect for our Black respondents in the earlier similarity survey analyses, it could be that similarity maps most directly to benevolence and that integrity matters more for these individuals in their choices. Differentiating the acute roles of these dimensions is a question for future work. Notably, a match for an underrepresented respondent never consistently influences perceptions of competence. Fifth, for overrepresented respondents, when there is a general trust matching effect, for educational prestige and religiosity, there also is an effect regarding competence (in Table 4, for overrepresented respondents, cells with 'general trust' always include 'competence'). Those with a college degree view scientists from elite institutions as more competent relative to scientists who attended public institutions, and non-religious individuals view scientists who do not signal religion as more competent than those who do signal religion (Fig. 4i,j). Non-religious individuals also perceive greater benevolence in

Table 4 | Conjoint study 2: summary of statistically significant results

Attribute (overrepresented level / underrepresented level)	Overrepresented respondents	Underrepresented respondents
Experienced	General trust, trustworthiness, integrity, benevolence, competence	General trust, trustworthiness, integrity, benevolence, competence
Gender (male/female)	–	General trust, trustworthiness, integrity, benevolence
Race/ethnicity (white/Black or Hispanic)	–	General trust (Black), trustworthiness (Black and Hispanic), integrity (Black), benevolence (Black and Hispanic)
Education (college/non-college)	General trust, trustworthiness, competence	–
Religiosity (secular/religious)	General trust, trustworthiness, integrity[a], benevolence, competence	Benevolence
Rurality (urban/rural)	Benevolence	General trust, trustworthiness, integrity, benevolence
Class (middle-upper/lower)	–	General trust, trustworthiness, integrity, benevolence

[a]This matching effect works in the opposite way than predicted, with non-religious (overrepresented) respondents perceiving more integrity among non-matched (religious) scientists.

non-religious scientists, but actually perceive scientists who signal religiosity as having more integrity.

The latter findings highlight the complex relationships between religiosity and scientists. Despite religious authorities in the USA initially playing a leading role in scientific pursuits[65], many Americans today perceive a conflict between religion and science[66]. Our results reveal some ambivalence, at least among the non-religious. The distinct roles of education and religion in influencing overrepresented individuals regarding competence show that these two characteristics differ from the others; they involve institutions that are intertwined with science. Education is a typical prerequisite for being a scientist, and, as mentioned, many view science and religion as at odds.

In sum, the results suggest that people underrepresented among scientists—women, Black individuals, those from rural areas and those with lower economic status—view concordant scientists as preferable, more benevolent and having more integrity. Furthermore, religious individuals view matched scientists as more benevolent. Increasing the presence of such scientists can ostensibly build trust in scientists among members of these communities. Alternatively, people overrepresented among scientists—men, white individuals, those from urban areas and those from upper classes—do not exhibit clear preferences one way or another. That said, highly educated and non-religious individuals prefer scientists from prestigious institutions and those who do not signal religiosity, viewing such scientists as more competent. To the extent that overrepresented individuals appear threatened by diversification, it would be along the lines of education and religiosity, a sensible finding given the nature of institutional ties between science, education and religion.

Discussion

Efforts to increase diversity among scientists have long been discussed. Even if these initiatives were pursued—and, at the time of this writing, they have largely stalled in the USA—it remains unclear whether they would succeed in generating a fully representative workforce since science training can span decades[67]. Common justifications to address underrepresentation among scientists include a moral equality imperative and potential gains in innovation and work quality[68–70]. We have identified a distinct benefit to diversification: increasing trust in scientists among those underrepresented in science fields, including women, Black people, people who reside in rural areas, religious individuals, and those from less advantaged economic backgrounds. Our evidence suggests this may reflect enhanced perceptions of benevolence and integrity in matched scientists. Moreover, we found scant evidence that those from overrepresented groups lose trust when scientists come from unmatched backgrounds, with the exceptions of religiosity and educational prestige. While others have identified specific examples of concordance in preferences regarding scientists[41] or medical providers[59,71], we have shown that such matching works even when many characteristics vary at once, and we identified the dimensions of trustworthiness that seem to matter most.

Increased trust makes it more likely that individuals follow the advice of scientists in crucial life-saving situations. Science and scientists have obvious limitations, but they should be accessible and potentially helpful to all citizens regardless of their backgrounds. Given the profound history of inequalities, this probably requires expanding the diversity of scientists. As Graves and colleagues[72] state, science should be "equitably distributed across society and…not entail costs borne by the already disadvantaged". An important question that is beyond our purview is whether diversifying science alters the production and communication of science in ways that align with the interests of historically excluded or mistreated groups.

We of course recognize other limitations to our analyses. First, the data come from a particular time period, preceding executive actions in the USA that altered priorities pertaining to science and that defunded several initiatives, especially those involving diversity, equity and inclusion. Second, the data are only from the USA, which surely has unique dynamics concerning the history of certain demographic groups (for example, Black Americans) and science. Nonetheless, future work exploring similar dynamics in other countries is vital. This is particularly the case given recent evidence of varying relationships between some characteristics (for example, religion) and trust in scientists across countries[29]. Third, our operationalizations are abstract; while some work suggests such abstraction is not a substantial detriment[73], the reality is that individuals may focus more or less on various characteristics in other contexts.

Fourth, our study of the dimensions of trust and trustworthiness provides insight into what dimensions may matter, but we are not able to directly link precise dimensions of trustworthiness to the behavioural intent measure. Fifth, we lack the statistical power to detect differences between dimensions (for example, what matters more—benevolence or integrity?). Along similar lines, we have insufficient power to explore intersectional effects, such as how Black women, a group that is often notably disenfranchised[74], react. There also may be variation in perceptions along different dimensions of trust across distinct types of scientists. Finally, a broader conceptual consideration is the role of the institutional prestige or elitism of scientists as experts. Our finding that college-educated individuals express a preference for scientists from elite, prestigious schools affirms such a dynamic. Cologna and colleagues[29] found that trust in scientists is negatively associated with science-related populist attitudes (that is, the belief that people's common sense is superior to scientists' expertise). Populist perspectives could operate via benevolence, with populists thinking that scientists do not operate in their interests. All of this raises fundamental questions about how institutional prestige has intersected and will intersect with science[75].

Even with these limitations, our results contribute to at least three additional lines of inquiry. First, as mentioned, trust in scientists in the twenty-first century in the USA has often been discussed in terms of the emergent partisan and ideological divides, with those on the left being more trusting and those on the right being less so[17,18,36]. We moved away from the political focus. It may appear puzzling how partisans and ideologues have polarized but groups have remained stable in their trust. Part of this reflects that many of the low-trusting individuals (for example, less educated, rural voters) migrated away from the Democratic Party and towards the Republican Party, while higher-trusting individuals (for example, non-religious, upper-class voters) did the reverse[76]. Consequently, solutions to political divides such as trust in scientists need not always focus on political solutions—indeed, one recent study reports that scientist-trust-building interventions that focus on conservative values, preferences or sources are ineffective[77]. Our findings suggest that an alternative is to attend to structural factors that generate partisan cleavages. Additionally, discussions about diversifying scientists need to account not just for contemporary constituencies on the left that often receive attention (for example, gender identity and race/ethnicity) but also for those on the right (for example, rurality and economic status).

Second, the matching results suggest a way to build trust. Yet, speaker characteristics alone may not always suffice. Besley and colleagues[26] make the astute point that a science communicator is unlikely to succeed by invoking calls for trust directly. Instead, speakers must build trustworthiness by attending to the relevant dimension in play. Our evidence suggests that for many groups, this entails highlighting the interests of the (low-trusting) stakeholders (benevolence) as well as fostering perceptions of integrity. The latter may be particularly important for Black individuals given the mixed results on similarity and benevolence (for example, from our survey and conjoint study) and the history of dishonesty inherent in race-based medical abuses[43,44]. For highly educated and non-religious individuals, competence seems most important. All of this highlights the role of targeted communication in science messaging[40].

Third, related to the prior point, having concordant scientists may not be feasible in many circumstances. As mentioned, the current composition of the scientific workforce and the long time horizon needed for change mean that matching speakers to audiences will often not be possible. That reality, along with the insights about the dimensions of trustworthiness[20,26], has implications for models of science communication[78]. Many approaches to science communication implicitly or explicitly proceed from a top-down dissemination perspective. Communication is viewed largely as a unilateral process where speakers transmit content to an audience. A common aim involves addressing deficits and pathologies with communications that, in essence, seek to 'correct' a belief or behaviour, such as closing gaps in literacy or epistemic knowledge, reframing a topic to alter opinions in a normatively desirable direction such as support for climate change initiatives, or intervening to prevent or update misperceptions. These approaches have a role to play in messaging about science. However, they are likely to be less effective at trust building. For instance, Koetke and colleagues demonstrated that intellectual humility can substantially increase trust in scientists[79]. Yet, they also found that it is challenging for a scientist to directly communicate their intellectual humility. Intellectual humility is often generated via interactive communication and listening that occur more in participatory models of science communication. In these settings, science communicators can work to signal allyship with different demographic and social groups, including those with marginalized identities, thereby building trust[80]. This nearer-term approach can be pursued by building bridges to underrepresented communities via partnerships that build trust[81].

Scientific information has long had a coveted place in societies because of its success in promoting well-being. Yet, just as the trust that one places in another is both precious and precarious, so is the place of scientists in society. Scientists can provide value with domain-specific insights, but they also have limitations. They have not been successful in closing trust gaps in the USA. This can be at least partially addressed by attending to the characteristics of scientists. Demographic realities make clear that there is no communicative silver bullet, but knowledge of factors that underlie trust in scientists provides guidance on how trust can be built and sustained.

Methods

All primary data collections received ethical approval. The COVID States similarity-to-scientists data collection was approved by Northeastern University (number 20-04-12). The conjoint study 1 data collection was approved by Northwestern University (STU00219054). The conjoint study 2 data collection was approved by the University of Rochester (STUDY00010121). Informed consent was obtained from all participants, and all participants were financially compensated. All reported statistical tests are two-tailed, and in no case was there repeated use of a sample. The similarity-to-scientists data employed a host of data quality filters that led to dropping some respondents (Supplementary Section 3). For the conjoint studies, participants who failed front-end attention checks had their participation terminated and were thus not available for analyses[82]. The data were analysed in Stata version 16.1 (ref. 83) and R 4.3.1 (ref. 84).

Trust in scientists over time

The data for tracking trust in scientists over time come from the General Social Survey, a probability, mostly face-to-face sample survey that charts social change in the USA. Since 1973, it has included a question that asks whether respondents have a great deal of confidence, only some confidence or hardly any confidence at all in the scientific community. Figure 1 plots the percentage by group who had a great deal of confidence in each year the survey collected data. We included data through 2024 and used weighted data (using the wtssall weight). The unweighted sample sizes for each year are as follows: 1973 (1,504), 1974 (1,484), 1975 (1,490), 1976 (1,499), 1977 (1,530), 1978 (1,532), 1980 (1,468), 1982 (1,860), 1983 (1,599), 1984 (1,473), 1986 (1,470), 1987 (1,819), 1988 (1,481), 1989 (1,537), 1990 (1,372), 1991 (1,517), 1993 (1,606), 1994 (2,992), 1996 (2,904), 1998 (2,832), 2000 (2,817), 2004 (2,765), 2006 (4,510), 2008 (2,023), 2010 (2,044), 2012 (1,974), 2014 (2,538), 2016 (2,867), 2018 (2,348), 2021 (4,032), 2022 (3,544) and 2024 (3,309). The unweighted percentage of female respondents, percentage of male respondents and average age for each year are as follows: 1973 (46.6%, 53.4%, 44.2), 1974 (46.6%, 53.4%, 44.6), 1975 (45.0%, 55.0%, 44.3), 1976 (44.6%, 55.4%, 45.3), 1977 (45.3%, 54.7%, 44.7), 1978 (42.0%, 58.0%, 44.0), 1980 (43.7%, 56.3%, 45.0), 1982 (41.9%, 58.1%, 44.9), 1983 (43.2%, 56.8%, 44.3), 1984 (40.6%, 59.4%, 44.0), 1985 (44.9%, 55.1%, 45.7), 1986 (42.2%, 57.8%, 45.4), 1987 (42.8%, 57.2%, 44.9), 1988 (43.1%, 56.9%, 45.4), 1989 (42.9%, 57.1%, 45.4), 1990 (44.0%, 56.0%, 46.0), 1991 (41.9%, 58.1%, 45.6), 1993 (42.7%, 57.3%, 46.0), 1994 (43.1%, 56.9%, 46.0), 1996 (44.2%, 55.8%, 44.8), 1998 (43.5%, 56.5%, 45.6), 2000 (43.6%, 56.4%, 46.0), 2002 (44.4%, 55.6%, 46.3), 2004 (45.5%, 54.5%, 46.0), 2006 (44.4%, 55.6%, 47.1), 2008 (46.0%, 54.0%, 47.7), 2010 (43.6%, 56.4%,48.0), 2012 (44.8%, 55.2%, 48.2), 2014 (45.0%, 55.0%, 49.0), 2016 (44.5%, 55.5%, 49.2), 2018 (44.8%, 55.2%, 49.0), 2021 (44.1%, 55.9%, 52.2), 2022 (46.2%, 53.8%, 49.2) and 2024 (44.6%, 55.4%, 50.4).

Details on the measures used to create the groups in Fig. 1 are provided in Supplementary Section 1. We used pairwise deletion to remove respondents with missing values. Supplementary Section 11 provides a discussion of the different trust-in-scientists measures used across data collections.

Similarity-to-scientists data

The similarity data come from the COVID States Project. The project relies on opt-in non-probability data from 22 vendors who use a variety of strategies and incentives to maintain online respondent panels. Details on recruitment, survey implementation and validation of the survey are provided in Supplementary Section 3. The data were collected between 29 June 2023 and 1 August 2023. We measured trust in scientists by asking, 'How much do you trust the following people and organizations to do what is right? - Scientists and researchers', on a four-point scale from 'not at all' to 'a lot'. (The survey asked about trust in various other entities as well.) The mean score was 3.13 (s.d. = 0.80) (Supplementary Section 4). To evaluate similarity to scientists, the survey asked, 'Do you think that people in the following professions are different from you or similar to you? Please answer on a scale from 0 to 100 where 0 is "very different" and 100 is "very similar".' The respondents rated 12 professions (for example, politician, bartender, teacher in grade school or police officer). The focus here is on scores representing respondent similarity to the profession of 'scientist'. The mean score was 37.18 (s.d. = 31.93). (We rescaled similarity to range from 0 to 1.) Details on the independent variable measures in Fig. 2 are provided in Supplementary Section 4. The respective sample sizes for Fig. 2a–c are 23,217, 22,688 and 22,635. The sample composition is 51% female, 48% male and 1% other gender. The sample's age distribution is as follows: '18 to 24' (12%), '25 to 34' (19%), '35 to 44' (17%), '45 to 54' (16%), '55 to 64' (17%) and '65 and over' (21%). (The ages sum to 102% due to rounding errors.) The similarity-to-scientists data were not preregistered. We used pairwise deletion to remove respondents with missing values.

Conjoint study 1

The data for the first conjoint study come from Bovitz Inc.'s Forthright panel, which provides nationally representative (non-probability, quota-based) USA samples. The data were collected from 11 December 2023 to 15 December 2023 (N = 1,220). The respondents completed a total of ten conjoint tasks, wherein they were presented with information about two scientists or physicians. They were then asked, 'Which scientist's advice would you follow?' (general trust) (see Supplementary Section 8 for the doctor version). The participants were blinded to randomization. The sample composition is 51% female, 48% male and 1% non-binary or other. The average age is 45.44 years (s.d. = 14.63). The marginal effects reported in Table 2 and Fig. 3 employ the delta method in computing the standard errors. For the underrepresented groups, the P values in Table 2 reflect the differences relative to the comparable overrepresented groups, whereas the confidence intervals in Table 2 and Fig. 3 reflect significance relative to 0. The text focuses discussion on the latter, but the substantive results are robust to either point of comparison. Additional details on the sample, stimuli, measures and precise question wording are provided in Supplementary Sections 5 and 8. The preregistration is available at https://aspredicted.org/tz2g-7kwm.pdf. The study was preregistered on 8 December 2023. Deviations from the preregistration include the composition of the sample being different in terms of the exact proportions of groups in the sample, the absence of a trust scale measure and the absence of identity importance measures. These deviations stemmed from decisions made at the point of implementation (considering costs).

Conjoint study 2

The data for the second conjoint study come from Bovitz Inc.'s Forthright panel. The data were collected from 17 January 2025 to 25 January 2025 (N = 3,031). The respondents completed a total of ten conjoint tasks, wherein they were presented with information about two scientists or physicians. The participants were randomly assigned to one of five conditions that varied whether they evaluated the scientists or physicians in terms of following their advice (general trust) (as in conjoint study 1), in terms of them being qualified (competence), in terms of them being honest (integrity), in terms of them being considerate (benevolence) or in terms of them being trustworthy (trustworthiness). The participants were blinded to randomization. The sample composition is 54% female, 45% male and 1% non-binary or other. The average age is 45.79 years (s.d. = 14.44). The marginal effects reported in Table 3 and Fig. 4 employ the delta method in computing the standard errors. For the underrepresented groups, the P values in Table 3 reflect the differences relative to the comparable overrepresented groups, whereas the confidence intervals in Table 3 and Fig. 4 reflect significance relative to 0. The text focuses discussion on the latter, but the substantive results are robust to either point of comparison. Additional details on the sample, stimuli, measures and precise wording are provided in Supplementary Sections 8 and 9. The preregistration is available at https://aspredicted.org/vxgv-xrzh.pdf. The study was preregistered on 11 January 2025. As a deviation from the preregistration, we did not include Asian American as a level for the race/ethnicity attribute (for simplification reasons). We also preregistered comparing effects across dimensions of trustworthiness (Supplementary Section 10).

Reporting summary

Further information on research design is available in the Nature Portfolio Reporting Summary linked to this article.

Data availability

All data needed to evaluate the conclusions in the paper are available via Harvard Dataverse at https://doi.org/10.7910/DVN/MS8VWZ.

Code availability

All code needed to reproduce the results in the paper are available via Harvard Dataverse at https://doi.org/10.7910/DVN/MS8VWZ.

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Author contributions

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Competing interests

The authors declare no competing interests.

Additional information

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Correspondence and requests for materials should be addressed to James N. Druckman.

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n/a	Confirmed	
☐	☑	The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement
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☐	☑	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
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☐	☑	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☐	☑	For null hypothesis testing, the test statistic (e.g. F, t, r) with confidence intervals, effect sizes, degrees of freedom and P value noted *Give P values as exact values whenever suitable.*
☑	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☑	☐	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
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Our web collection on statistics for biologists contains articles on many of the points above.

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Policy information about studies with human participants or human data. See also policy information about sex, gender (identity/presentation), and sexual orientation and race, ethnicity and racism.

Reporting on sex and gender	For the similarity data, 51% female, 48% male, and 1% other gender. For the first conjoint study, 51% female, 48% male, and 1% non-binary or other. For the second conjoint study, 54% female, 45% male, and 1% non-binary or other.
Reporting on race, ethnicity, or other socially relevant groupings	For the similarity data, 12% Black, 6% Asian American, 16% Hispanic, 65% white, and 1% other. For the first conjoint study, 34.51% Black, 19.75% Hispanic or Latino, and 45.74% white. For the second conjoint study, 34.18% Black, 19.76% Hispanic or Latino, and 46.06% white.
Population characteristics	Based on census or other government source, GSS, or cited source.
Recruitment	NORC (for GSS), PureSpectrum (for COVID States), Bovitz Inc. (for conjoints).
Ethics oversight	Northeastern University (#20-04-12), Northwestern University (STU00219054), University of Rochester (STUDY00010121).

Note that full information on the approval of the study protocol must also be provided in the manuscript.

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Life sciences study design

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Sample size	
Data exclusions	
Replication	
Randomization	
Blinding	

Behavioural & social sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	Data from the GSS were obatined from the GSS website. COVID States data came from a data collection from that project. The conjoint experiments were original data collections.
Research sample	Sample characteristics are in the Methods Section and Supporting Information. The GSS were collected by NORC, COVID States were collected via PureSpectrum, and the coinjoints were collected via Bovitz, Inc.
Sampling strategy	GSS is a probability sample of the U.S., COVID States is a quota sample, and the conjoints are quota samples.
Data collection	GSS data were colleceted in-person, on-line, and via phone. All other data were on-line surveys.
Timing	The GSS data were from 1973-2024. The COVID States data were from June 29, 2023 to August 1, 2023. The first conjoint study data were from December 11-15, 2023. The second conjoint study data were from January 17-25, 2025.
Data exclusions	For the conjoint experiments, only self-reported white, Black, and Hispanic repsondents were included. The conjoint experiments and the data from the COVID States project employed attention filters.
Non-participation	We used pairwise deletion for respondents missing values on the variables analyzed.
Randomization	For the conjoint experiments, assignment probabilities were .5 for all attributes other than race (.5 white and .5 distributed between the other races/ethnicities) and middle class respondents for class (.5 middle class, .25 upper class, .25 lower class).

Ecological, evolutionary & environmental sciences study design

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Study description	
Research sample	
Sampling strategy	
Data collection	
Timing and spatial scale	
Data exclusions	
Reproducibility	
Randomization	
Blinding	

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Field work, collection and transport

Field conditions	
Location	
Access & import/export	
Disturbance	

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Materials & experimental systems

n/a	Involved in the study	
☐	☐	Antibodies
☐	☐	Eukaryotic cell lines
☐	☐	Palaeontology and archaeology
☐	☐	Animals and other organisms
☐	☐	Clinical data
☐	☐	Dual use research of concern
☐	☐	Plants

Methods

n/a	Involved in the study	
☐	☐	ChIP-seq
☐	☐	Flow cytometry
☐	☐	MRI-based neuroimaging

Antibodies

Antibodies used	
Validation	

Eukaryotic cell lines

Policy information about cell lines and Sex and Gender in Research

Cell line source(s)

Authentication

Mycoplasma contamination

Commonly misidentified lines
(See ICLAC register)

Palaeontology and Archaeology

Specimen provenance

Specimen deposition

Dating methods

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Laboratory animals

Wild animals

Reporting on sex

Field-collected samples

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Clinical data

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Clinical trial registration

Study protocol

Data collection

Outcomes

Dual use research of concern

Policy information about dual use research of concern

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Could the accidental, deliberate or reckless misuse of agents or technologies generated in the work, or the application of information presented in the manuscript, pose a threat to:

No | Yes

- [ ] [ ] Public health
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- [ ] [ ] Any other significant area

Experiments of concern

Does the work involve any of these experiments of concern:

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- [ ] [ ] Demonstrate how to render a vaccine ineffective
- [ ] [ ] Confer resistance to therapeutically useful antibiotics or antiviral agents
- [ ] [ ] Enhance the virulence of a pathogen or render a nonpathogen virulent
- [ ] [ ] Increase transmissibility of a pathogen
- [ ] [ ] Alter the host range of a pathogen
- [ ] [ ] Enable evasion of diagnostic/detection modalities
- [ ] [ ] Enable the weaponization of a biological agent or toxin
- [ ] [ ] Any other potentially harmful combination of experiments and agents

Plants

Seed stocks

Novel plant genotypes

Authentication

ChIP-seq

Data deposition

- [ ] Confirm that both raw and final processed data have been deposited in a public database such as GEO.
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Data access links
May remain private before publication.

Files in database submission

Genome browser session
(e.g. UCSC)

Methodology

Replicates

Sequencing depth

Antibodies

Peak calling parameters

Data quality

Software

Flow Cytometry

Plots

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Methodology

Sample preparation

Instrument

Software

Cell population abundance

Gating strategy

- [ ] Tick this box to confirm that a figure exemplifying the gating strategy is provided in the Supplementary Information.

Magnetic resonance imaging

Experimental design

Design type

Design specifications

Behavioral performance measures

Imaging type(s)

Field strength

Sequence & imaging parameters

Area of acquisition

Diffusion MRI [ ] Used [ ] Not used

Preprocessing

Preprocessing software

Normalization

Normalization template

Noise and artifact removal

Volume censoring

Statistical modeling & inference

Model type and settings

Effect(s) tested

Specify type of analysis: ☐ Whole brain ☐ ROI-based ☐ Both

Statistic type for inference

(See Eklund et al. 2016)

Correction

Models & analysis

n/a	Involved in the study
☐	☐ Functional and/or effective connectivity
☐	☐ Graph analysis
☐	☐ Multivariate modeling or predictive analysis

Functional and/or effective connectivity

Graph analysis

Multivariate modeling and predictive analysis