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Scientists' identities shape engagement with environmental activism

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Scientists are increasingly joining environmental movements. As knowledge producers and influential figures in society, scientists are uniquely positioned to drive change. Here we explore how scientist identity shapes engagement in environmental activism using qualitative and quantitative data from a multinational survey of 329 scientists from 41 countries. Scientist identity content, specifically perception of the science-activism relationship, was a stronger explanatory variable than strength of identification as a scientist. Perceiving a harmonious relationship between science and activism, endorsing environmental stewardship as a scientist's duty, and believing objectivity and impartiality remained uncompromised by activism, each had significant correlations with engagement. These components formed a composite variable, which remained a robust explanatory variable of engagement even when accounting for the influence of activist identity. Scientists embracing scientist-activist compatibilism were also less inclined to view new technologies as a panacea for the climate crisis. This research underscores the important role of scientist identity content in shaping climate actions and perspectives.

Climate change and biodiversity loss pose major threats to both human[1] and ecological[2] systems. Yet there is a significant gap between the scientific consensus[3–5] and policy action to change the trajectory[5–7]. Beyond solely conducting research, scientists are now actively participating in environmental social movements to translate scientific knowledge into tangible actions[8–10], often explicitly invoking scientist identity by wearing white lab coats. While there is a rich history of individual scientist-activists like Albert Einstein, Jane Goodall, and Carl Sagan, the climate crisis has brought to the forefront the question of whether scientists should engage as a collective in advocacy and activism. Involvement presents a dilemma, as the scientific community traditionally emphasizes objectivity and neutrality, discouraging overt political engagement[11–16]. Consequently, politically active scientists find themselves challenging established scientific norms. This paper examines the associations between identity processes and climate action among environmentally concerned scientists.

Scientists and environmental social movements

2017's worldwide March for Science was a catalyst for scientist-activism, with demonstrators marching in defense of scientific research and evidence-based policymaking[17]. It marked a significant moment in the broader discussion concerning the role of scientists as advocates and activists. This was not a one-off event. Scientists have engaged in diverse actions, blocking fossil fuel infrastructure[18], leaking the IPCC Report[19], and symbolically pasting scientific papers to government buildings[8]. Not only are climate and earth systems scientists engaged in action[20]. Groups like Scientists for Extinction Rebellion[21] and Scientist Rebellion[21] include various natural and social scientists underscoring the interdisciplinary nature of environmental activism and highlighting the collective commitment across scientific disciplines. Furthermore, diverse scientific societies recognize the imperative for action. For example, the American Psychological Association has highlighted psychologists' critical role in research, community outreach, and advocacy, demonstrating widespread recognition of the urgency to address environmental challenges and the need for interdisciplinary collaboration[22]. These examples underscore how scientists are challenging conventional expectations of what it means to be a scientist.

The scientist identity: detached observer or public actor?

Scientist identity encompasses perceived norms, responsibilities, and values associated with being a scientist. Traditionally, scientists have been represented as impartial observers, conducting research, and offering evidence-based knowledge to inform policy-making and societal decision-making. Historically, the separation of science and advocacy, rooted in ideals of objectivity and impartiality, was argued to maintain science's integrity by reducing the influence of politics[23]. More recent arguments similarly stress separation of science and advocacy as crucial for upholding the integrity[11,12], and credibility[13–16], of scientific inquiry. However, the robustness of the science on the adverse global effects of climate change[5] has emboldened others to challenge these social norms arguing that scientists have a social

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and intellectual responsibility to act, and that maintaining scientific detachment is morally and intellectually unsustainable[9,24,25]. Furthermore, academics have long critiqued this division since science inherently intersects with social, cultural, and political dimensions[26–29]. Nonetheless, scientists' perceptions of these norms affect what they feel it is acceptable to do. Interviews with IPCC authors highlighted a tension between their desire to be politically active while adhering to values of objectivity and scientific credibility[30]. Earth and environmental scientists expressed fears they would lose credibility amongst their peers for speaking up in public[31].

Despite these tensions, there is increasing evidence of widespread support for scientist advocacy and activism both from the public[32] and within academia[32–34], suggesting a shift in how the scientist identity is conceptualized. However, engagement in activism is much lower than individual researchers' willingness to engage[33,34]. In line with the wider social psychological literature[35–39], two large scale UK[33] and international[34] surveys both highlighted the role of negative perceptions of personal and collective efficacy, uncertainty about what to do, being connected with activists, and identification as an activist as factors moderating activism engagement. High workloads[33], inflexible institutions[33], and feelings of responsibility[34], are additional factors for researchers. This emerging trend raises critical questions about the intersection of scientist identity with activism, prompting an examination of how the traditional scientist identity, rooted in objectivity and impartiality, aligns or conflicts with the inherently political nature of activism.

Activism and social identity

To understand the motivations driving scientists to engage in climate action, it is helpful to draw from the collective action literature. Identity processes are central to political engagement[40]. Social identity theory posits that identification with a particular social group, along with group norms and values, shapes behavior and actions[41,42]. From a social-identity perspective, identifying as both a scientist and activist is likely to entail unique challenges, since the values associated with each may be perceived in conflict. Environmental activist identity, as a shared politicized social identity[43], is critical for shaping motivations, behaviors, and self-perceptions of individuals engaged in environmental social movements[36,44,45]. However, as a politicized identity, it may be perceived as at odds with the supposedly apolitical scientist identity, with its emphasis on objectivity and impartiality, creating a unique tension for environmentally concerned scientists. This raises the question of how scientists, engaged to a greater or lesser extent in advocacy and activism, manage the relative inter-identity fit between being a scientist and being an activist[45].

The current research

The key question pursued in this research concerns whether core scientific values of objectivity and impartiality are perceived as compromised by activism, and whether this perceived tension relates to a scientist's degree of engagement in activism. We looked at this in several respects. First, we examined whether scientist identity—both strength of identification and the specific contents of a scientist's beliefs--played a unique role in motivating action, beyond the influence of other relevant factors, including perceptions of psychological closeness of climate change[39], personal and collective pro-environmental identities[36,38], social[35,36] and ingroup norms[36], having activist friends[35], and a sense of collective efficacy[36,37]. Within academia, high work demands and potential negative perceptions from colleagues and academic institutions[24] may also pose barriers to action. Second, we employed a qualitative approach (thematic analysis) to explore the content of scientists' beliefs about the interplay between science and activism.

Finally, we explored how scientists' identity might relate with endorsement of 'techno-solutionism'[46] i.e., the idea that all problems, including social, political, and cultural, are best solved by technology[47]. Techno-solutionism might attract certain scientists as a more controllable and less disruptive approach to addressing complex issues like climate change. From this viewpoint, climate change mitigation could be achieved via a 'technical fix'[48] without the need for action outside the remit of science. Consequently, 'techno-solutionism' could act as a countervailing force to collective action, as far as scientists are concerned.

Study aims and hypotheses

This pre-registered study aimed to understand the role of a scientist's social identity on activism engagement. Our research offers valuable insights into the determinants of scientists' involvement in climate change activism and their perceptions of the interplay between science and activism.

We hypothesized that:

1. Stronger identification with a scientist identity will be positively associated with greater engagement in climate change activism.
2. Stronger identification with an activist identity will be positively associated with participation in climate change activism.
3. Increased perceptions of compatibility between science and activism will be positively associated with participation in climate change activism.
4. Participants who strongly identify as scientists but perceive incompatibility between science and activism will be more likely to endorse techno-solutionism as a response to climate change.

To explore the relationship between a scientist's identity, both in terms of strength and content, and engagement in environmental activism, a sample of 329 natural and social scientists from 41 countries (41.64% UK; 14.29% USA; 7.3% Germany; 4.56% Australia; 3.65 % Ireland) was recruited. Approximately half the sample (53%) indicated they were part of an activist group, such as Extinction Rebellion, Greenpeace, and Scientist Rebellion. Participants responded to measures of the strength of their identification with a scientist identity, the strength of their identification with an activist identity, their beliefs about the compatibility of science and activism (reflecting the content of their scientist identity, including values related to objectivity, impartiality, and a scientist's duty to advocate for the environment), their perceptions of whether activism compromised a scientist's reputation or credibility, and their level of engagement in environmental activism. In addition, a measure was included to assess beliefs about 'techno-solutionism'. Last of all, participants reported the impact of other engagement factors including perceptions of action efficacy, personal connections with activists (having activist friends or family), work commitments, and family commitments (see Methods for full list). These items were included to explore the relative impact of scientist identification when considered against more traditional structural impediments to action. Open-ended questions were included to provide additional context regarding perceived obstacles to, and benefits of, action.

To determine the relative importance of each variable for engagement, we built a set of regression models. These aimed to examine the association between our measured variables and the frequency of environmental activism, as well as the willingness to endorse techno-solutionism as a response to climate change. This allowed us to analyze not only the relationships between the measured variables and the outcome measures, but also the relative explanatory weight of each variable within the model. Given the approximately even split between activist group members and non-members, we conducted additional analyses to compare the factors influencing scientists' activism between these two distinct groups. This comparison helped explore differences and assessed the robustness of our analyses, as group membership serves as another measure of activism engagement. Additional analyses were performed to examine differences between the natural and social sciences (see Supplementary Note 5).

Results

The data used to generate these results, along with the R code written to run the analyses, are publicly available[49,50].

Activism engagement

Contrary to Hypothesis 1, scientist identity did not significantly correlate with activism engagement, $r(327) = 0.08$, $p = 0.17$. The belief that activism can harm a scientist's reputation and credibility did not significantly correlate with activism engagement, $r(327) = -0.09$, $p = 0.09$. Consistent with Hypothesis 3, endorsement of scientist-activist compatibilism contributed to engagement. Believing objectivity and impartiality were uncompromised by activism (scores for objectivity and impartiality were reverse-scored for analysis, as detailed in the methodology section), endorsing environmental stewardship as a scientist's duty, and that it is possible to be a scientist and an activist, were all positively associated $r(327) = 0.25$ to 0.36 (all p's < 0.001). Principal components analysis revealed these different aspects of scientist-activist compatibilism formed a single composite variable showing good internal consistency ($\alpha = 0.76$) and had a strong association with activism engagement, $r(327) = 0.42$, $p < 0.001$ (see Supplementary Note 1, Supplementary Table 6). The sample broadly agreed that activism and science were compatible (*Mean* = 4.2, *SD* = 0.70, range 1 (Strongly Disagree) – 5 (Strongly Agree)), with 18 participants (5.5%) expressing disagreement, and a further 6 (1.82%) expressing neither agreement nor disagreement.

A final model $R^2 = 0.52$, $F(4, 324) = 90.13$, $p < 0.001$, including age, scientist-activist compatibilism, level of interest in activism, and activist identity was significantly associated with engagement (see Table 1). All variables in the final model were robust to multiple testing and the influence of activist identity (all variables satisfied the Bonferroni corrected alpha level of 0.009 for the final model). A large effect size[51] was observed for the model. There were no issues of multicollinearity (all VIFs <3). To check the stability of the model, we performed bootstrapped regressions with 10,000 iterations, revealing all confidence intervals closely mirrored the original model's findings (see Supplementary Note 3), further affirming the model's reliability. For correlations between variables, see Supplementary Table 1a, b.

Consistent with Hypothesis 2, activist identity contributed the largest amount of variance in activism engagement, but other factors explained additional variance. In addition to the positive effects of age, and accounting for the level of interest in activism, scientist-activist compatibilism was a significant explanatory variable. Scientist-activist compatibilism exhibited no significant relationship with scientist identification ($r = 0.02$, $p = 0.70$), indicating the distinct nature of scientist identity strength from identity content. Furthermore, an interaction analysis was performed to investigate the interplay between scientist identity strength, scientist-activist compatibilism, and activism engagement, finding no interaction (see Supplementary Note 4).

All other potential engagement factors were assessed for relationships with activism engagement (see Table 2). Uncertainty about the effectiveness of action, uncertainty about which actions to take, and not having personal connections with activists, were negatively correlated with activism engagement. Experiencing family commitments, and the impact of COVID-19, were positively correlated with engagement. Financial and work commitments, transport access, and visa and residency concerns exhibited weakly positive but non-significant correlations with engagement.

Techno-solutionism

Most participants disagreed with ($n = 243$, 74%) or expressed uncertainty about techno-solutionism ($n = 50$, 15%), while 11% ($n = 36$) endorsed it. Contrary to Hypothesis 4, scientist-identity strength was not associated with techno-solutionism, $X^2(1, N = 329) = 2.67$, OR = 1.02 [1.00, 1.05], $p = 0.10$. However, higher scientist-activist compatibility scores were uniquely associated with a lower likelihood of techno-solutionism (see Table 3), $X^2(1, N = 329) = 36.76$, OR = 0.80 [0.74, 0.86], $p < 0.001$, supporting Hypothesis 4 that scientists who viewed science and activism as incompatible were more likely to endorse techno-solutionism. In comparison, higher scientist-activist compatibility scores were uniquely associated with a higher likelihood of support for changing political systems as the sole solution $X^2(1, N = 329) = 11.12$, OR = 1.13 [1.05, 1.22], $p < 0.001$.

Comparison of activist group members with non-group members

Compared to group-member scientists, non-group-member scientists expressed significantly less interest in and engaged less in activism (see Table 4 for all results). They also tended to be younger, significantly identified less as activists, were more uncertain about action effectiveness, were less likely to construe the scientist identity as compatible with activism, were more worried of what others might think of them, and were relatively more supportive of techno-solutionism (though on average still disagreed with it).

Scientist identity strength did not differ between the activist group and non-activist-group scientists. However, for activist group members, scientist-identity strength correlated with activism, $r(172) = 0.25$, $p < 0.001$. This was not the case for non-group members, $r(153) = -0.01$, $p = 0.91$. Scientist-identity strength showed a significant independent association with activism (see Table 5). The overall model was significant, $R^2 = .31$, $F(6, 167) = 13.78$, $p < 0.001$. A large effect size[51] was observed for the model. There were no issues of multicollinearity (all VIFs <3). When including activist identity, the overall model improved $F(7, 166) = 20.75$, $p < 0.001$, a large effect size. However, scientist-identity strength was no longer significant, which further highlights the important role of activist identity for activism engagement.

Thematic analysis: scientist identity and activism

As scientist-identity content played an important role, we explored this content qualitatively. Thematic analysis of open responses (see Supplementary Notes 6, 7, & 8); see Methods for analysis procedure) on factors preventing action ($n = 292$) and benefits gained from action ($n = 275$) revealed diverse constructions of scientist identity in relation to activism. Below we discuss five key constructions concerning participants' management of the tension between science and activism.

Traditional views on scientist identity. Several respondents voiced concerns aligning with traditional notions of scientific objectivity and research integrity. One respondent emphasized the fundamental principle underscoring the perceived risk of activism compromising scientific impartiality, "A researcher/scientist should be objective, and activism threatens scientific integrity." Another echoed this sentiment, "Scientists should produce quality research and information, not shout around." These quotes highlight participants' commitment to the primacy of scientific rigor over advocacy. This elevation of scientific values (e.g., objectivity) may delegitimize activism within the scientific community by framing it as antithetical to established norms and practices.

Activism as a professional obligation. In contrast, others articulated that being a scientist compels action. One respondent spoke of activism as being not merely a personal choice, but a professional and ethical obligation:

For me, it is a moral duty. I would not feel I was doing right by my responsibilities as a scientist, as someone who understands the risks, if I was not doing my best to create change, and activism is an effective avenue for this.

This perspective sees activism as a natural extension of the scientist's role in society driven by a sense of duty to address pressing issues based on scientific evidence. As another participant put it, "I feel the responsibility to try to do something as part of the mandate of my job, as my salary is paid by public moneys, and it would be unethical not to say what I see." For others, activism is seen not only as a responsibility but enhances the integrity and credibility of their scientific endeavors, "Seeing that I am willing to put my body and energy in this fight makes my work more credible and compelling."

Managing the reputation of the 'scientist'. Some individuals expressed concern that activism may impact *perceptions* of scientific objectivity, particularly when scientists advocate in a professional capacity. One respondent raised the issue of the perceived compromise in objectivity when scientists advocate as scientists, rather than as private individuals:

Perception of reduced objectivity: this is a sticky one, but I do think there's a cost to engaging too much in activism as it involves making

Table 1 | Comparison of multiple regression models with activism-engagement as criterion

Explanatory variable	b	b 95% CI [LL, UL]	Std. Error	Beta	beta 95% CI [LL, UL]	Std. Error	r	Fit	Difference
(Intercept)	−9.71	[−21.92, 2.51]	6.209	0	[−0.09, 0.09]	0.046			
Impact on self	2.6	[−0.43, 5.63]	1.542	0.13	[−0.02, 0.27]	0.075	0.19***		
Impact on close others	−0.02	[−3.26, 3.22]	1.646	0	[−0.15, 0.15]	0.076	0.23***		
Age	0.25***	[0.15, 0.34]	0.049	0.26***	[0.16, 0.36]	0.051	0.24***		
Scientist-activist compatibility	1.26***	[0.85, 1.66]	0.205	0.32***	[0.22, 0.42]	0.052	0.42***		
Uncertainty about effectiveness of action	0.04	[−0.92, 1]	0.487	0	[−0.1, 0.11]	0.052	−0.20***		
Family commitments	0.83	[0.09, 1.57]	0.376	0.1	[0.01, 0.2]	0.047	0.17**		
Lack of interest	−2.56***	[−3.66, −1.46]	0.561	−0.25***	[−0.35, −0.14]	0.054	−0.38***		
Uncertainty about which actions to take	−0.68	[−1.64, 0.29]	0.491	−0.07	[−0.18, 0.03]	0.053	−0.15**		
Not knowing others taking action	−0.02	[−0.95, 0.9]	0.471	0	[−0.1, 0.1]	0.05	−0.15**		
								$R^2 = 0.32$ ***	
(Intercept)	−12.57	[−22.81, −2.33]	5.204	0.01	[−0.07, 0.08]	0.038			
Impact on self	2.29	[−0.25, 4.83]	1.291	0.11	[−0.01, 0.23]	0.062	0.19***		
Impact on close others	−0.91	[−3.62, 1.81]	1.38	−0.04	[−0.17, 0.08]	0.063	0.23***		
Age	0.14***	[0.05, 0.22]	0.042	0.14***	[0.06, 0.23]	0.044	0.24***		
Scientist-activist compatibility	0.48**	[0.11, 0.84]	0.184	0.12**	[0.03, 0.21]	0.046	0.42***		
Uncertainty about effectiveness of action	0.4	[−0.41, 1.2]	0.409	0.04	[−0.04, 0.13]	0.044	−0.20***		
Family commitments	0.38	[−0.24, 1.01]	0.317	0.05	[−0.03, 0.13]	0.04	0.17**		
Lack of interest	−1.27**	[−2.22, −0.32]	0.482	−0.12**	[−0.21, −0.03]	0.046	−0.38***		
Uncertainty about which actions to take	−0.39	[−1.2, 0.42]	0.412	−0.04	[−0.13, 0.04]	0.044	−0.15**		
Not knowing others taking action	0.01	[−0.77, 0.78]	0.394	0	[−0.08, 0.08]	0.042	−0.15**		
Activist identity	0.61***	[0.51, 0.71]	0.052	0.56***	[0.46, 0.65]	0.048	0.70***		
								$R^2 = 0.52$***	$\Delta R^2 = 0.20$***
(Intercept)	−5.61	[−12.64, 1.43]	3.577	−0.5	[−1.08, 0.08]	0.295			
Age	0.13***	[0.06, 0.21]	0.038	0.14***	[0.06, 0.22]	0.04	0.24***		
Scientist-activist compatibility	0.47**	[0.12, 0.82]	0.179	0.12**	[0.01, 0.07]	0.016	0.42***		
Lack of interest	−1.25**	[−2.13, −0.37]	0.447	−0.12**	[−0.19, −0.03]	0.04	−0.38***		
Activist identity	0.62***	[0.52, 0.72]	0.051	0.57***	[0.48, 0.66]	0.047	0.70***		
								$R^2 = 0.52$***	$\Delta R^2 = 0.00$

A significant b-weight indicates the beta-weight and semi-partial correlation are also significant. b represents unstandardized regression weights. beta indicates the standardized regression weights. r represents the zero-order correlation. LL and UL indicate the lower and upper limits of a confidence interval, respectively.
$^{*}p < 0.03$; $^{**}p < 0.01$; $^{***}p < 0.001$.

statements which are value-based or worded too strongly. Nothing wrong with making these statements but often we make these 'as Scientists' so as to give our actions and words more weight. But the weight comes in part from a perception of objectivity which is based on being more cautious in our communications, which creates a tension. Some activist/scientists have recently tried to dismiss this tension, which I think is unhelpful.

For others, their personal pro-environmental values do not inherently bias their research, but they recognize the potential impact on their credibility:

I believe my work is meaningful, and that it contributes to helping society be better positioned to deal with climate change… A big part of my credibility, I think, is that I can provide analysis from arms length. I don't believe my values about environmental issues are a cause for bias, but given the existing social and political context around climate and environmental issues I do believe that perception of me as an activist would undermine the contribution I can make through my research. Many people who are not sold on climate action see activists as part of an out group. I see my role as including bridging that divide (from both directions), and being perceived as on neither side is critical to that.

This quote underscores the belief that pro-environmental values do not bias their work, yet the public might believe it does and this may be reason to avoid activism.

One respondent, a professional ecologist actively engaged in activism, spoke of challenges faced when activism intersects with scientific identity. They expressed frustration at being labeled a "tree hugger" and the consequent erosion of their credibility, "it really annoys me as I am a professional with many years of study and experience behind me… If only there was a professional and scientific way of protesting!"

Table 2 | Activism engagement correlations with barrier items Means, standard deviation and Pearson correlations for activism frequency and barrier variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Activism frequency	1.45	0.56	–	–	–	–	–	–	–	–	–	–	–	–
2. Work commitments	3.23	1.32	0.12	–	–	–	–	–	–	–	–	–	–	–
3. Financial commitments	2.20	1.24	0.08	0.24***	–	–	–	–	–	–	–	–	–	–
4. Transport access	1.98	1.09	0.10	0.2***	0.48***	–	–	–	–	–	–	–	–	–
5. Unsure about effectiveness of action	2.67	1.20	−0.2***	−0.03	−0.03	−0.05	–	–	–	–	–	–	–	–
6. Family commitments	2.53	1.41	0.17**	0.36***	0.15**	0.12	−0.01	–	–	–	–	–	–	–
7. Visa residency concerns	1.64	1.28	0.05	0.12	0.18***	0.21***	−0.05	0.06	–	–	–	–	–	–
8. Worried about others might think about you	1.96	1.04	−0.06	0.15**	0.03	0.01	0.18***	0.12	0.02	–	–	–	–	–
9. Lack of interest	1.86	1.08	−0.38***	−0.13*	−0.08	−0.08	0.41***	−0.07	0	0.21***	–	–	–	–
10. Unsure about which actions to take	2.60	1.20	−0.15**	0.16**	0.24***	0.24***	0.3***	0.07	0.1	0.23***	0.19***	–	–	–
11. Lack of energy	2.88	1.23	0.04	0.3***	0.23***	0.23***	0.12	0.07	0.01	0.11	0.01	0.19***	–	–
12. Covid-19	2.48	1.30	0.16**	0.27***	0.29***	0.31***	−0.06	0.16**	0.11	0.08	−0.11	0.14*	0.23***	–
13. Don't know any friends or family involved	2.05	1.19	−0.15**	−0.02	0.22***	0.19***	0.16**	0.02	0.02	0.16***	0.18***	0.36***	0.23***	0

M and SD are used to represent mean and standard deviation, respectively.
*$p < 0.03$; **$p < 0.01$; ***$p < 0.001$.

Table 3 | Comparison of cumulative link models with support for 'inventing new technologies is the sole way to successfully solve climate change' as the criterion

Explanatory variable	b	b 95% CI [LL, UL]	Std. Error	z	Odds ratio	Odds ratio 95% CI [LL, UL]	Log Likelihood	χ2	AIC	R 2
Impact on close others	0.22	[−0.2, 0.44]	0.317	0.70	1.25	[0.67, 2.35]				
Impact on self	−0.28	[−0.47, 0.17]	0.298	−0.92	0.76	[0.42, 1.36]				
Age	0	[−0.23, 0.18]	0.009	−0.24	1	[0.98, 1.02]				
Scientist-activist compatibility	−0.22***	[−0.85, −0.42]	0.039	−5.78	0.80	[0.74, 0.86]				
							−418.80	38.51***	853.60	0.04
Impact on close others	0.24	[−0.38, 0.88]	0.32	0.75	1.27	[0.68, 2.41]				
Impact on self	−0.27	[−0.86, 0.32]	0.298	−0.90	0.76	[0.42, 1.37]				
Age	0	[−0.02, 0.02]	0.009	−0.01	1	[0.98, 1.02]				
Scientist-activist compatibility	−0.21***	[−0.29, −0.12]	0.043	−4.81	0.81	[0.75, 0.88]				
Activist identity	−0.01	[−0.03, 0.01]	0.012	−0.87	0.99	0.97, 1.01]				
							−418.42	39.27***	854.84	0.04
Scientist-activist compatibility	−0.23***	[−0.3, −0.15]	0.037	−6.06	0.80	[0.74, 0.86]				
							−419.23	36.76***	848.46	0.04

LL is the log-likelihood. AIC and BIC are the Akaike Information Criterion and Bayesian Information Criterion, respectively, which weigh model fit against model complexity, in related though somewhat different ways. The χ 2 values pertain to the likelihood ratio test comparing the given model with the null model; all three are significant at α = .0001. The R 2 values reported are McFadden's pseudo- R 2 values, which for any model M are defined as 1 minus (log-likelihood of M/log-likelihood of null model) LL and UL indicate the lower and upper limits of a confidence interval, respectively.
*$p < 0.03$; **$p < 0.01$; ***$p < 0.001$.

Supporting rather than participating in activism. Another perspective asserts that the tension can be managed by supporting rather than participating in activism, "I believe it's better if scientists actively support activists rather than being activists, e.g. Scientists for Future. Different groups have different roles to play and we need coalitions that include as many roles as possible, rather than just activists." This suggests that scientists should adopt a role aligned with the traditional view of scientists as information providers to activists, rather than being advocates themselves. Scientists for Future is mentioned as an example of this approach and contrasted with scientist-led groups who take a more direct-action approach such as Scientists for Extinction Rebellion and Scientist Rebellion. Another perspective emphasized support over participation, "I choose to financially support larger environmental organizations, such as the RSPB and the Woodland Trust, who I believe are more effective influencers, and so I 'contract out' my activism to others."

Counterpoint: techno-solutionist perspective. One respondent advocated for a techno-solutionist approach to environmental challenges. Their perspective was that science and technology will provide the solution and therefore a scientist's capacity to enact change is realized through their work:

Table 4 | Comparison of key variables by group membership

	Part of a group ($N = 174$)		Not part of a group ($N = 155$)			
	M	SD	M	SD	*T* Test (Welch)	Wilcoxon rank sum test
Explanatory variable						
Scientist identity	5.2	1.04	5.31	0.96	1.05	NA
Activist identity	5.29	1.07	4.11	1.2	−9.31***	NA
Scientist-activist compatibility	4.37	0.57	4.01	0.79	−4.59***	NA
Impact on self	4.69	0.54	4.63	0.54	−1.07	12,572
Impact on close others	4.79	0.47	4.66	0.55	−2.26*	11,883*
Age	42.19	12.89	37.66	9.92	−3.61***	NA
Dependent measures						
Activism engagement	1.76	0.46	1.10	0.44	−13.21***	NA
Inventing new technologies is the only way to successfully tackle climate change	1.87	0.93	2.23	1.16	3.11**	15,762***
Changing political systems is the only way to successfully tackle climate change	3.96	1.09	3.7	1.17	−2.1	11,702
Changing human behavior is the only way to successfully tackle climate change	3.59	1.17	3.75	1.17	1.22	14,564
Additional engagement factors						
Work commitments.	3.34	1.28	3.12	1.36	−1.53	12,198
Financial limitations.	2.26	1.2	2.14	1.29	−0.98	12,480
Transport access	2.14	1.12	1.81	1.02	−2.74**	11,192**
Unsure about the effectiveness of activism.	2.48	1.18	2.88	1.19	3.06**	16,079**
Family commitments.	2.62	1.41	2.43	1.41	−1.25	12,342
Concerns about visa/residency.	1.6	1.23	1.68	1.34	0.61	13,881
Fears/worries about what other people might think of you.	1.84	0.97	2.1	1.1	2.24*	15,228
Lack of interest in activism.	1.56	0.86	2.21	1.18	5.61***	17,846***
Unsure about what actions you can take.	2.49	1.14	2.73	1.26	1.81	14,862
Lack of energy	2.9	1.2	2.85	1.27	−0.37	13,158
Concern about Covid-19.	2.52	1.24	2.43	1.37	−0.63	12,696
Don't know any family, friends, or colleagues engaged in climate action.	1.98	1.13	2.12	1.25	1.11	14,035

Wilcoxon rank sum tests were performed for all Likert items as an additional robustness check under the assumption that any relationships present should appear using both parametric and non-parametric tests.
*$p < 0.03$; **$p < 0.01$;***$p < 0.001$.

I have decided a better use of my time is to get people off this rock. Only when we have billions of people living in a innumerable number of free space habitats will we truly add resilience to the human species. Moving heavy industry off Earth is the only way to turn this planet into an environmental preserve. The faster the better.

Discussion

The current research highlights the importance of scientist-identity construction for both activism engagement and inclination toward techno-solutionism.

Scientist identity, environmental activism, and techno-solutionism

Our findings demonstrate that the strength of a scientist's identification as a "scientist" did not significantly correlate with activism across the sample, nor did concerns over potential damage to a scientist's reputation and credibility. A more notable factor was how scientists formulated the content of their scientist identity. While our results are consistent with prior studies indicating a strong link between pro-environmental identity and environmental activism[36,38], they also reveal that scientist-identity content contributes additional variance. Those who considered activism to be compatible with science, felt a responsibility as a scientist to protect the environment, believed that activism does not compromise scientific objectivity and impartiality, reported greater engagement in activism. Furthermore, belief in scientist-activist compatibility was largely orthogonal to identifying as a scientist. Overall, these results suggest that the relationship between scientist identity and environmental activism is far from straightforward and hinges significantly around scientist identity construction. Arguments for[9,31,52] and against[14,15] scientist advocacy illustrate diverse conceptualizations of the scientist identity.

The qualitative responses illustrated diverse scientist identity constructions. Some aligned with traditional norms of objectivity and research integrity, viewing activism as incompatible with established norms and practices citing compromised objectivity, integrity, and research quality. Conversely, others viewed activism as a moral responsibility for scientists as a natural extension of their role. Moreover, analysis revealed more complex perspectives which grappled with balancing objectivity, integrity, and a desire for impact. Despite an insignificant statistical relationship, scientists expressed concern about credibility when advocating for environmental causes. This is seen in nuanced identity formulations, neither entirely for nor against scientist activism but sensitive to context. They recognized the tension of engaging in activism while maintaining objectivity and acknowledged the risk of undermining public perception of impartiality. To safeguard credibility, some scientists preferred to distance themselves from

Table 5 | Comparison of multiple regression models with activism frequency as criterion for activist group members (*N* = 174)

Explanatory variable	b	b 95% CI [LL, UL]	Std. Error	Beta	Beta 95% CI [LL, UL]	Std. Error	r	Fit	Difference
(Intercept)	−11.74	[−26.7, 3.22]	7.576	0.38	[0.27, 0.49]	0.057			
Impact on self	2.05	[−1.2, 5.3]	1.645	0.1	[−0.06, 0.26]	0.08	0.14		
Impact on close others	0.91	[−2.85, 4.67]	1.906	0.04	[−0.13, 0.21]	0.088	0.23***		
Age	0.21**	[0.11, 0.31]	0.05	0.22**	[0.12, 0.32]	0.052	0.30***		
Scientist-activist compatibility	1.11**	[0.58, 1.65]	0.272	0.28**	[0.14, 0.42]	0.068	0.38***		
Lack of interest	−2.5**	[−3.9, −1.1]	0.707	−0.24**	[−0.38, −0.11]	0.068	−0.28***		
Scientist Identity	0.21**	[0.07, 0.35]	0.071	0.15**	[0.05, 0.25]	0.051	0.25***		
								$R^2 = 0.31$ ***	
(Intercept)	−11.9	[−25.3, 1.5]	6.786	0.25	[0.14, 0.36]	0.055			
Impact on self	2.55	[−0.37, 5.46]	1.475	0.12	[−0.02, 0.26]	0.071	0.14		
Impact on close others	−0.54	[−3.94, 2.86]	1.721	−0.02	[−0.18, 0.13]	0.079	0.23***		
Age	0.13**	[0.04, 0.22]	0.046	0.13**	[0.04, 0.23]	0.049	0.30***		
Scientist-activist compatibility	0.67**	[0.17, 1.17]	0.253	0.17**	[0.04, 0.29]	0.064	0.38***		
Lack of interest	−1.8**	[−3.07, −0.53]	0.642	−0.17**	[−0.3, −0.05]	0.062	−0.28***		
Scientist Identity	0.08	[−0.06, 0.21]	0.067	0.05	[−0.04, 0.15]	0.048	0.25***		-
Activist identity	0.48***	[0.33, 0.62]	0.074	0.44***	[0.3, 0.57]	0.067	0.61***		
								$R^2 = 0.44$***	$\Delta R^2 = 0.13$***

A significant b-weight indicates the beta-weight and semi-partial correlation are also significant. b represents unstandardized regression weights. beta indicates the standardized regression weights. r represents the zero-order correlation. LL and UL indicate the lower and upper limits of a confidence interval, respectively.
*$p < 0.03$; **$p < 0.01$; ***$p < 0.001$.

activism, preferring instead that scientists serve as information providers rather than advocates, aligning with traditional scientific roles. Meanwhile, others engaged in activism expressed a desire for a more professional and scientific approach to advocacy to manage this tension. These perspectives highlight how scientist identity construction can either delegitimize or legitimize action, depending on how values of objectivity, credibility, and professional duty are invoked. This emphasizes the importance of understanding the unique ways in which scientists construct their identities given the role they play in whether and how scientists act.

Despite these challenges, our findings demonstrate that many scientists do engage in activism. This aligns with recent evidence suggesting a majority of scientists and researchers support the idea of increasing advocacy efforts[33,34]. For example, a survey of more than 9000 researchers found that a majority strongly supported researcher climate advocacy (51%), albeit this dropped to 36.7% for protest specifically[34]. These findings may reflect a form of pluralistic ignorance[53], with individual scientists privately supporting advocacy but perceive less support among their peers. Meanwhile, the above research indicates a potential gap between individual perceptions and broader attitudes within the scientific community. This suggests that the perceived tension between activism and scientific credibility might not be as widespread among scientists as some fear. Furthermore, concerns about public trust and credibility appear to be unfounded. A recent 67 country study ($N = 71,417$), found that there is moderately high trust in scientists and that a majority believe scientists should be engaged in society and more policymaking[54].

While our participants, in general, did not strongly support techno-solutionism, those who viewed their scientist identity as incompatible with activism tended to endorse techno-solutionism more frequently. The large proportion of activist group members in this research might explain the low levels of endorsement. However, other research on scientist attitudes found comparable levels of disagreement: 43.5% strongly disagreed that climate change will be largely solved by technology compared with 27.5% who agreed[34]. Though emerging technologies such as novel forms of carbon capture and storage[55], solar geoengineering[56], and nuclear fusion[57] are touted as potential solutions, scaling them up poses ethical[58,59] and practical challenges[55,60]. Some argue that putting too much stock in technological "myths" that have yet to deliver can promote inaction[61]. For instance, exposure to mitigation solutions like greenhouse-gas removal may discourage measures to mitigate climate change such as reducing emissions[62]. This emphasizes the importance of scientists' self-conception in shaping the strategies they support for addressing climate change.

Although the strength of scientist identity was not associated with engagement in activism across the entire sample, a notable distinction emerged when examining scientists who reported involvement in an activist group as part of their climate change activism. Within this subgroup, strength of scientist identity was associated with increased engagement in activism. One possible explanation is that through involvement in activism, scientists' identity becomes intertwined with their activist identity. This may be particularly true within activist groups that utilize the "scientist" identity. For example, when UK scientists protested planned fossil fuel expansion, they wore white lab coats with the message "I'm a Scientist" alongside their pro-environmental message "New Oil and Gas = Death"[8]. This foregrounding of the scientist identity during action may help facilitate the integration of scientist and activist identities.

Other factors impacting environmental activism

Our findings revealed that older individuals were more likely to actively participate in climate activism. This finding aligns with potential challenges faced by younger scientists, such as academic precarity, including contract insecurities, power-imbalances, heavy workloads[63], and lack of seniority[64], which may limit opportunities for activism. Conversely, more established scientists might feel secure enough to act on longstanding convictions, possibly invigorated by the recent wave of climate activism. Another explanation could be that older adults feel a sense of legacy and intergenerational obligation, implying that this is a different part of a life-cycle rather than a generational divide[65].

Several other factors, identified in prior research, correlated negatively with activism, including uncertainty about action effectiveness, lack of knowledge about what to do, and not knowing other activists. The present findings combine with past research to emphasize the importance of collective efficacy[43], personal efficacy[66], and proximity to activist networks[67] and a supportive social context[35] in fostering pro-environmental behaviors and climate advocacy[36,67].

The weak relationship activism had with other factors proposed as barriers suggests that motivated scientists find ways to manage potential limitations[35,68]. Financial and work commitments, transport access, visa and residency concerns, and fears about others' perceptions, did not significantly hinder scientists' activism. This aligns with previous research showing that, despite potential impediments, scientists are politically active. For instance, a survey on general political advocacy with the Union of Concerned Scientists found that scientists were far more politically active than the general public[10]. Half of respondents had attended one or more demonstrations, in addition to other forms of advocacy such as petition signing and financial donations.

Rather than posing strict barriers to activism, the present study found *positive* associations between activism and both family commitments and experiencing COVID-19 impacts. One interpretation of these relationships is that highly engaged activists are more attuned to the inherent tensions between activism and potential barriers, such as the time demands of activism conflicting with family responsibilities. Of course, the present study cannot establish whether activists experience these impediments more often than non-activists. Active and non-active individuals may experience the same impediments to action[35], but it is plausible that certain factors, such as scientist identity content, might play a role in motivating action, although this is speculative.

Future research directions

This study has identified several promising avenues for future research. Identity processes are central to understanding political advocacy and can serve as "antecedents, mediators, moderators, or consequences of such actions"[40]. Politicization involves identity content change which can affect the actions an individual is willing to take[69]. For scientists, the question is how the process of becoming politically engaged corresponds with changes in identity content. Researchers should explore the bi-directional dynamics of political engagement and scientist identity construction. The open responses suggest there are a variety of identity constructions on this issue which are associated with varying degrees of engagement. By examining diverse constructions of scientist identity, researchers could uncover how different values, beliefs, and experiences influence scientists' approaches to climate change.

Expanding the sample to include a broader spectrum of scientists, including those less engaged in activism, would enhance representativeness. In addition, a more diverse sample would enable further investigation into solution preferences across different fields. This could shed light on whether certain disciplines exhibit distinct perspectives on environmental challenges and activism.

Finally, it was not possible to determine whether aligned identity content preceded or proceeded from engagement given the design. Longitudinal research could examine the dynamic nature of identities by tracking changes in scientists' identities before and after engagement in climate action. For example, interviews and ethnographic fieldwork could illuminate how individual scientists navigate and reconcile core scientific values of objectivity and impartiality with their moral convictions, shedding light on the complex interplay between scientist identity content, moral responsibility, and motivations for climate action. By doing so, researchers could better understand the temporal relationship between changes in identity content and engagement in climate action among scientists. In addition, this will allow researchers to examine how these changes relate to other established factors contributing to engagement such as collective and personal efficacy, proximity to activist networks, and supportive social dynamics.

Conclusion

This study offers important insights into factors shaping scientists' engagement in climate change activism. This research underscores the important association between scientists' identity contents, encompassing values of objectivity, impartiality, and a sense of duty to address environmental issues, and their public climate change actions and perspectives on techno-solutionism. In conclusion, this research offers a crucial starting point for a more comprehensive understanding of the complexities of scientists' identities as scholars and activists in a world confronting the escalating threats of climate change.

Methods

This study was preregistered on the open science framework and reports of all measures, manipulations, and exclusions, as well as data, analysis code, and materials are available for download (see data and code availability statements). Participants provided written informed consent (via a form in Qualtrics) prior to commencing the study.

Sample

Power analysis, based on a recent meta-analysis of studies examining identity correlations with climate-friendly intentions and behaviors[38], determined a required sample size of 374 participants for correlations at 0.15 and above, with a 90% statistical power and a significance level of 0.05[70]. Gpower was used for sample size calculation.

Participants were recruited via opportunity sampling on Twitter and via various scientific societies and were not paid for participation. Recruitment aimed for diversity among natural and social scientists concerned about climate change and who participated or not in climate-related advocacy and activism. Responses were collected between 12/02/2022 and 01/10/2022. Twitter was, at the time as a hub for scientific communication and connecting scientists[71], served as a suitable platform for recruiting scientists. Since its takeover and subsequent change to X many scientists have now left the site[72], though this occurred after data collection had ceased. Academic societies and environment centers were also targeted, including the Centre for Climate and Social Transformations at Cardiff, the Lund Sustainability Institute, and the Lancaster Environment Centre.

We specifically targeted scientists and social scientists concerned about climate change, whether engaged in activism or not. This focus was crucial for examining activism attitudes and behaviors within the scientific community. Although it excluded unconcerned or indifferent scientists, it aligned with understanding motivations and barriers to activism among those aware of and concerned by the issues. Additionally, both natural and social scientists were recruited to reflect the diverse representation seen in movements like Scientists for Extinction Rebellion and Scientist Rebellion, ensuring a comprehensive view of scientific activism on climate change and representing a wide range of scientific perspectives on environmental activism.

Four-hundred and fifty-four participants opened the survey, and 329 participants completed it (54.1% female, 40.7% Male, 2.4% Non-binary, 2.7% preferring not to say, M_{age} = 40.11 years, SD = 12.03, range = 22–77). 68 of these did not consent to participation and returned their submission. A further 23 consented but did not answer any questions. Finally, another 34 started but answered only a couple of questions before returning their submission. These partial responses were not considered for analysis. This criterion was essential to ensure a comprehensive assessment of the variables relevant to the research project. Given recent recommendations concerning alpha levels[73], to increase confidence in the observed results, by minimizing Type 1 error rates, a sample-standardized alpha was calculated:

$$\alpha stan = \alpha orig / \sqrt{\frac{N}{100}} \tag{1}$$

After removing incomplete responses, the final sample was sufficiently powered (90%) to find correlations of 0.19 at the revised alpha level.

Participants were from 41 countries (41.64% UK; 14.29% USA; 7.3% Germany; 4.56% Australia; 3.65 % Ireland) and resided in 32 countries (51.37% UK; 11.55% USA; 5.17% Australia; Germany 3.95%; Canada 3.34%). In the recruitment of our study participants, we acknowledge that the UK is overrepresented in our sample. This is reflective of the UK's prominent role in recent climate activism and the establishment of key global activist groups such as Extinction Rebellion (of which Scientists for Extinction Rebellion are a part) and Scientist Rebellion. These movements have gained substantial traction and mobilized many scientists. As their discipline, 92 participants listed psychology (28% of sample), 62 biology (20%), 43 earth science (13%), 42 sociology (13%), and 25 engineering and technology (8%). One-hundred and fifty-nine participants reported natural science as their primary discipline and 169 reported social science. Ninety participants listed two academic disciplines, and 28 listed three. The mean political ideology score on economic issues was 1.73 ($SD = 0.96$), and on social issues was 1.43 ($SD = 0.82$), scales ranging from 1 (Very liberal) to 4 (Moderate) to 7 (Very conservative).

Data validation

To ensure data integrity, validity checks were implemented, including only complete responses for core measures and a CAPTCHA verification step to prevent automated bot participation. The high response rate for open-ended questions underscored participant engagement, with 292 participants identifying hindrances to action and 275 elaborating on perceived benefits, aligning directly with study objectives. Finally, a paired t-test revealed a significant difference between scientist ($M = 5.26$, $SD = 1$) and activist identity strength ($M = 4.73$, $SD = 1.27$), $t(328) = 6.36$, $p < 0.001$, reinforcing confidence in the recruitment strategy's effectiveness in targeting scientists with varying degrees of identification with environmental activism.

Measures

Note: A variety of scale formats were employed, including validated measures such as the social identity scales, climate risk perceptions, and activism engagement measure, alongside new items. The diverse nature of these measures prevented standardization to a common scale. However, correlations and regression results, including standardized weights, were analyzed to assess variable relationships. The use of a 5-point Likert scale for new items aligned with the established format of the climate risk perceptions scale, ensuring coherence and comparability across survey responses. For key variable distributions please see Supplementary Figs. 1 through 5.

Scientist identity. The relative strength of scientist identity was measured using eight items adapted from a validated measure of social identity[74], e.g., "I have a lot in common with scientists", half of which were reverse scored. Options were scored from 1 (Strongly Disagree) – 7 (Strongly Agree). Higher scores indicate stronger identification. The scale had excellent internal consistency ($\alpha = 0.91$), with a mean of 5.26 ($SD =$ 1), indicating a moderate level of identification as scientists.

Environmental-activist identity. The relative strength of environmental-activist identity was measured using eight items adapted from a validated measure of social identity[44,74], half of the which were reverse scored, e.g., "The idea that I am an environmental activist rarely enters my mind". Options were scored from 1 (Strongly Disagree) – 7 (Strongly Agree). Higher scores indicate stronger identification. The scale had good internal consistency ($\alpha = 0.86$), with a mean of 4.73 ($SD = 1.27$), suggesting agreement with activist identity, although falling between "neither agree nor disagree" and "somewhat agree."

Scientist-activist compatibility. Four statements, generated by the authors, assessed views on the compatibility of being both a scientist and activist: "If I engaged in environmental activism, this would compromise my ability to be objective" (reverse-scored); "It is the responsibility of a scientist to remain completely impartial, and engagement in environmental activism is a great risk to this impartiality" (reverse-scored); "Being a scientist requires taking a stand for the environment"; "You can be both a scientist and an environmental activist". Options were scored from 1 (strongly disagree) to 5 (strongly agree). Principal components analysis and reliability testing found that the four statements functioned as an internally consistent index ($\alpha = 0.76$; loadings ranged from 0.70 to 0.84, see Supplementary Note 1, Supplementary Table 6). Higher scores indicate higher science and activism compatibility ($M = 4.2$, $SD = 0.70$, range: 1−5). Two other statements assessed concerns that engaging in activism would jeopardize one's reputation or credibility as a scientist: "If I engaged in environmental activism, others would see me as biased" (reverse-scored); "Engaging in environmental activism does not jeopardize my reputation as a scientist". Reliability testing found that both statements had an acceptable level of reliability as a two-item measure ($\alpha = 0.66$; loadings ranged from 0.79 to 0.85). Higher scores indicate that activism does not affect a scientist's reputation and credibility ($M = 3.21$, $SD = 0.92$).

Climate change risk perceptions. As a control measure, the perceived risk of climate change was assessed using two items adapted from validated items[75] rated on a 1 (strongly disagree) to 5 (strongly agree) scale of agreement, "Do you believe you will be negatively affected by climate change in your lifetime?" ($M = 4.66$, $SD = 0.54$, range: 2−5); "Do you believe those close to you, such as your friends and family, will be negatively affected by climate change?" ($M = 4.73$, $SD = 0.51$, range: 2−5).

Activism-engagement. Activism-engagement was assessed using an adapted version of the activism orientation scale[76] to measure self-reported frequency of environmental activist behaviors. Participants were asked, "How often do you engage in the following activities related to environmental activism?", followed by 20 items completing this stem, e.g., "Display a poster or bumper sticker with an environmental message". Respondents indicated how often they engage in each behavior using a scale with points of 0 (never do this), 1 (rarely do this), 2 (sometimes do this), or 3 (often do this). Higher scores indicate higher levels of activism. The scale demonstrated excellent internal consistency ($\alpha = 0.91$). The mean score was 1.45 ($SD = 0.56$), falling between "rarely" and "sometimes", indicating a moderate level of activism involvement.

Techno-solutionism. To assess techno-solutionist inclinations, participants were presented the statement: "Inventing new technologies is the only way to successfully tackle climate change" and provided their level of agreement from 1 (strongly disagree) to 5 (strongly agree) ($M = 2.04$, $SD = 1.06$, range: 1−5). The item was phrased strongly (new technologies are the '*only way*') to avoid ceiling effects, since most individuals likely agree that new technologies are important for tackling climate change. Formulated this way, agreement scores represented an endorsement of new technologies as the sole or primary solution. Two other statements related to "changing political systems" ($M = 3.84$, $SD = 1.14$, range: 1−5) and "changing human behavior" ($M = 3.84$, $SD = 1.14$, range: 1−5) were included, with similar strong phrasings. These items were included to provide alternatives to techno-solutionism as it was expected that scientists who viewed science as compatible with activism would show preference for political rather than technical solutions (see Supplementary Tables 8 and 9).

Other engagement factors. Other possible factors affecting engagement were identified from the authors' fieldwork with environmental activists and scientists and previous studies of volunteering and activism engagement[24,35]. Participants were asked, "Have you experienced any of these barriers to participating in any form of environmental activism?" and they indicated how much each item affected their participation in activism on a scale of 1 (no impact) to 5 (very significant impact). These included: *Work commitments, Family commitments, Financial limitations, Transport access, Concerns about visa/residency, Unsure about the* *effectiveness of activism, Unsure about what actions you can take, Don't know any family, friends, or colleagues engaged in climate action, Lack of interest in activism, Fears/worries about what other people might think of you, Lack of energy, and Concern about Covid-19*. Concern about COVID-19 was included as a control measure if required. The twelve items did not form a reliable index ($\alpha = 0.62$) nor did a principal components analysis reveal any reduced item indexes (see Supplementary Note 2). Therefore, the items were tested individually.

Note: The term barrier was initially used but has since been reevaluated to better reflect the complexity of factors influencing engagement in environmental activism. In the paper, these factors are referred to as "additional factors" to emphasize their contribution to shaping activism participation. This adjustment acknowledges that while the items previously labeled as barriers remain relevant, other variables such as activist identity and scientist-activist compatibilism may also negatively impact engagement and could be conceptualized as barriers in specific contexts. Thus, using a broader term ensures clarity and inclusivity in discussing the various influences on activism engagement.

Open response questions. Respondents were given an opportunity to write responses to two questions, '3 things that prevent people like you from taking action' and '3 things that people like you gain from taking action'.

Demographic questions. Measures of ethnicity, gender, age, and political orientation were included as demographic variables. Political orientation on social and economic issues were assessed using a 1 (left/liberal) to 7 (right/conservative) Likert scale.

Procedure

All materials were presented to participants via Qualtrics. After providing informed consent, participants completed the scientist and activist identity scales (administered in a counter-balanced order), followed by scientist-activist compatibility, climate change risk perceptions, activism-engagement, solutions to climate change, pragmatic barriers, activist group membership, and, lastly, demographics. Item presentation within each scale was randomized using Qualtrics' randomization tool.

Analysis plan

Regression models. The pre-registered analysis plan required the use of appropriate logic models (dependent on the distribution of the data) to assess relationships with activism and techno-solutionism. Activism frequency scores were normally distributed. However, techno-solutionism was positively skewed. Standard multiple regression was used with activism as the outcome measure. A cumulative link model[77] was used with techno-solutionism as the outcome measure, which treats the outcome variable as an ordinal variable without assuming equidistance between response categories[78]. Where multiple testing was performed, i.e., to assess the unique contribution of variables in hierarchical tests, the alpha level was Bonferroni corrected to minimize Type I error rates. Please see the equation below:

$$(\alpha new = \alpha orig/n) \quad (2)$$

Predictors were chosen based on their relationship with each dependent measure. Activist identification was expected to significantly relate to activism-engagement. We were interested in which variables contributed beyond activist identity and climate change risk perceptions. Thus, the multiple regression was performed in three steps. In step one, we constructed a model including risk perceptions, scientist-activist compatibility, pragmatic barriers, and age. In step two, we included activist identity to assess which predictors were robust to the influence of activist identity. In step three, we reduced the number of variables (choosing only those that were significant in the latter model) to determine the leanest model that explains the most variance. The same stepwise procedure was used for the cumulative link model. To check the stability of the model, we performed bootstrapped regressions with 10,000 iterations, to confirm the model's reliability (see Supplementary Note 4). The same stepwise procedure was used for the cumulative link model.

Outliers. A comprehensive outlier diagnostic was performed, examining leverage, Cook's distance, and covariance ratios. A small subset of the data (approximately 2.7% of the sample, or 9 cases) were flagged as potential outliers. However, upon further analysis, including examination of large residuals and overall distribution, we determined these cases did not significantly alter the model's findings. Despite a slight improvement in fit (Adjusted R-squared value of 0.598, compared to 0.52 in the original model), we opted to retain the full dataset, prioritizing data integrity and generalizability. All analyses, including the outlier analysis, are documented and accessible on the Open Science Framework (OSF) for transparency and reproducibility purposes.

Comparison between group and non-group member scientists. Approximately half the sample (53%) reported their membership of an activist group. To explore the effects of group identification processes, we compared activist group members with non-activist group members. To assess the significance of mean differences between the groups for each variable, we performed a Welch's *t*-test. This test was chosen due to the unequal sample sizes and the assumption of unequal variances. As a robustness check, given the ordinal nature of Likert items, we also performed a Wilcoxon rank sum test to examine potential differences. The use of both parametric and non-parametric tests ensured the robustness and reliability of our findings. We then employed regression models, as outlined above, to determine the distinct contributions of each variable.

Principal components analysis. A principal components analysis (PCA) was conducted to determine if beliefs about science and activism, and the various additional factors, fit together into respective sub-scales (see Supplementary Notes 1 and 2, Supplementary Tables 6 and 7). PCA is useful for reducing complex datasets into fewer components[79,80]. We also ran a parallel analysis using the Parallel Analysis Engine[81] to determine the number of factors to retain by simulating 100 random datasets. The 'psych'[82] software package in R Studio, with 'oblimin' rotation, was used for conducting the PCA on the dataset.

Thematic analysis of open responses. We collected 292 responses to the question, '3 things that prevent people like you from taking action,' and 275 responses to the question, '3 things that people like you gain from taking action.' To analyze open-ended responses, we employed thematic analysis[83,84] to gain deeper insights into the quantitative findings and uncover unexpected insights. Several factors guided method choice. Thematic analysis is well-suited for uncovering the processes that shape meanings and assumptions[85] and extracting general patterns. Thematic analysis offered flexibility in identifying patterns across the entire dataset. Our analytical approach was primarily inductive, focusing on data-based meanings. We define themes as patterns of shared meaning, united by a central concept or idea[85,86]. We have been diligent and transparent in this process to ensure the robustness of our findings. We invite other researchers to conduct their own analyses on the open responses, as we have made them available for examination after removing any identifiable data and detaching them from other survey components.

We adhered to a structured process. Initially, we familiarized ourselves with the data by carefully reviewing all responses, generating an extensive list of unique codes. These codes were then organized within an Excel spreadsheet, and responses corresponding to each code were marked with '1' for reference. Subsequently, we searched for potential themes by grouping related codes, considering their conceptual coherence, distinctiveness, and alignment with our research questions. A critical review of these themes followed to ensure they made sense and remained distinct. As part of the refinement process, we assigned meaningful names to each theme and provided brief descriptions to offer context. Throughout this analysis, we maintained flexibility to revisit earlier steps as necessary to maintain thoroughness.

Software for analyses. All statistical analyses were performed in R[87] using RStudio[88]. Main analyses were conducted using the following packages; base R, 'car'[89], 'HMisc'[90], 'matrixTests'[91], ordinal[92], 'psych'[82] and 'QuantPsyc' 1.5[93] packages.

Limitations. While this study provides insights into the relationship between scientist identity, scientist-activist compatibility beliefs, and activism engagement, certain limitations should be considered when interpreting the study's findings. The study encountered uncertainties and potential biases related to data collection and analysis. Opportunistic sampling may have influenced the sample composition and introduced several limitations. While this method facilitated recruitment, it also led to a sample that leaned heavily towards scientists with activist affiliations, potentially biasing the findings towards individuals already inclined towards environmental activism. While this bias facilitated comparisons between activist and non-activist scientists, future research could include a more diverse range of participants to capture a broader spectrum of perspectives and experiences.

Additionally, the geographical skew in the sample, with a predominant representation of scientists from the Global North, particularly the UK, may further limit the generalizability of the findings. While the sample predominantly consisted of scientists from the Global North, particularly the UK, this overrepresentation is somewhat justified given the region's prominence in recent climate activism involving scientists The emergence of groups like Scientists for Extinction Rebellion and Scientist Rebellion, originating in the UK, underscores the significance of this region in climate activism within the scientific community. Nevertheless, this geographical skew limits the study's global applicability, particularly given the greater vulnerability of Global South regions to climate hazards[1]. The study may not fully represent the experiences and viewpoints of scientists in the Global South, where contextual differences could significantly influence patterns of social movement participation. Moreover, the opportunistic sampling strategy may have contributed to the overrepresentation of certain fields and disciplines while underrepresenting others. Efforts were made to include scientists from diverse backgrounds, but this approach may have inadvertently skewed the sample composition.

The correlational nature of this research precludes ascertaining causal relationships. Although the findings suggest a positive relationship between the strength of scientist identity and activism-engagement among activist group-affiliated scientists, further research is needed to understand this relationship and the role of core scientific values. Longitudinal studies could shed light on how scientist identity, its compatibility with activism, and the perceived legitimacy of climate action evolve and influence each other over time. While scientists joining social movements may initially perceive science and activism as compatible, their subsequent experiences could shape this perception and long-term engagement.

Although there was no significant relationship between reputational concerns and activism engagement, future research could examine their potential impact further, especially in the context of publicly visible actions. The complexity and depth of the open responses indicate that there may be additional factors influencing engagement beyond what was captured by the quantitative analysis, indicating the need for further qualitative research to explore other factors.

Lastly, the political bias observed in our sample towards both social and economic issues is worth mentioning. While the results remain valid within this context, extending research to more politically diverse samples could yield a more comprehensive understanding of the factors influencing scientists' activism-engagement.

Data availability

All anonymized data[50] are study are available in the Open Science Framework repository: https://osf.io/w8qje/.

Code availability

All computer code[49] generated for analyses are available in the Open Science Framework repository: https://osf.io/wvb7m/?view_only=5e4ed30bfed749448e2c41af3b3a66ea.

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Author contributions
Samuel Finnerty designed the study, collected the data, and carried out both the quantitative and qualitative analyses with input from Jared Piazza and Mark Levine. Samuel Finnerty wrote the manuscript with contributions from all coauthors.

Competing interests
The authors declare no competing interests.

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