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# Inoculating against threats to climate activists' image: Intersectional environmentalism and the Indian farmers' protest

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ABSTRACT

An emerging strategy in climate movements is to build solidarity with other social movements to mobilize climate action—but can this backfire? In a pre-registered experiment (N=541 Indian adults), we investigated the effect of Greta Thunberg's tweets expressing solidarity with the Indian farmers' protest on Indians' receptivity to her climate advocacy and their intentions to take collective climate action. Protest support moderated the effect of her tweets such that after reading her tweets, those who opposed the farmers' protest found Thunberg to be less effective as a climate advocate compared to the control condition. Exposure to the tweets also lowered protest opposers' collective climate action intentions. In contrast, those who supported the farmers' protest became more receptive to her climate advocacy after reading her tweets. Pre-emptively clarifying Thunberg's motives using an image-prepare pre-bunk inoculated against the negative effects on her image– protest opposers who received the pre-bunk before reading Thunberg's tweets were as receptive to her as were protest opposers in the control condition. The results suggest that climate advocates' intervention in other social movements can polarise the public's opinion about them and the public's pro-climate action intentions. This unintended effect may be mitigated by clarifying advocates' motives before they intervene.

## 1. Introduction

The Indian farmers' protest began in Northern India, in September 2020 and demanded that the government repeal three 'farm laws'. With changes such as allowing agro-businesses to engage farmers in direct contracts without state regulation, the laws were set to privatise agriculture (Sinha and Bhogal, 2021). They also heightened fears that the government could revoke policies that guarantee farmers a minimum price for staple crops like rice and wheat (Curtis, 2021). In response, several thousand people joined the farmer's protest movement across the country and internationally (Mashal et al., 2021). The Indian state countered anti-government sentiment by claiming that farmers were being misled by the political opposition, leading to many Indians opposing the farmers' protest (Venkataramakrishnan, 2021).

In February 2021, prominent climate activist Greta Thunberg tweeted in support of the farmers' protest and shared a toolkit outlining how citizens can contribute (Fig. 1). Notably, much of the farmer's protest did not explicitly bring up environmental concerns (Sinha and Bhogal, 2021). And, despite the farm laws' possible implications for cropping patterns and water scarcity, Thunberg's tweets also did not comment on the environmental and climate impacts of the farm laws. Therefore, Thunberg's expression of solidarity arguably reflects a larger strategic turn towards intersectional climate movements that build solidarity with other social movements, even those that need not be centred around environmental issues per se (Oglesby, 2021). Such expressions of solidarity with other movements not only recognise that there can be alliances between seemingly diverse challenges, but also offer an opportunity to build broad-based support for climate action (for example, among farmers in this case).

Thunberg's tweets, however, received a polarised response, eliciting both strong support and censure. She faced major backlash from some: her social media was flooded with negative comments and her effigies were burned by large crowds. Many Indians saw her tweets as an attempt to interfere with the country's internal politics, incite violence, and broaden political divide (Ellis-Petersen, 2021a).

How does building cross-movement solidarity impact the climate movement? This study examines the impact of Greta Thunberg's expression of solidarity with the Indian farmers' protest. Although familiarity with Greta Thunberg is associated with enhanced collective action intentions in Western contexts (Sabherwal et al., 2021), this study is the first to assess her influence in a non-Western context. We examine if Thunberg's expression of support for the farmers' protest can threaten her image as a climate advocate i.e., lower Indians' receptivity to her climate advocacy, and lower Indians' intentions to take collective ac-

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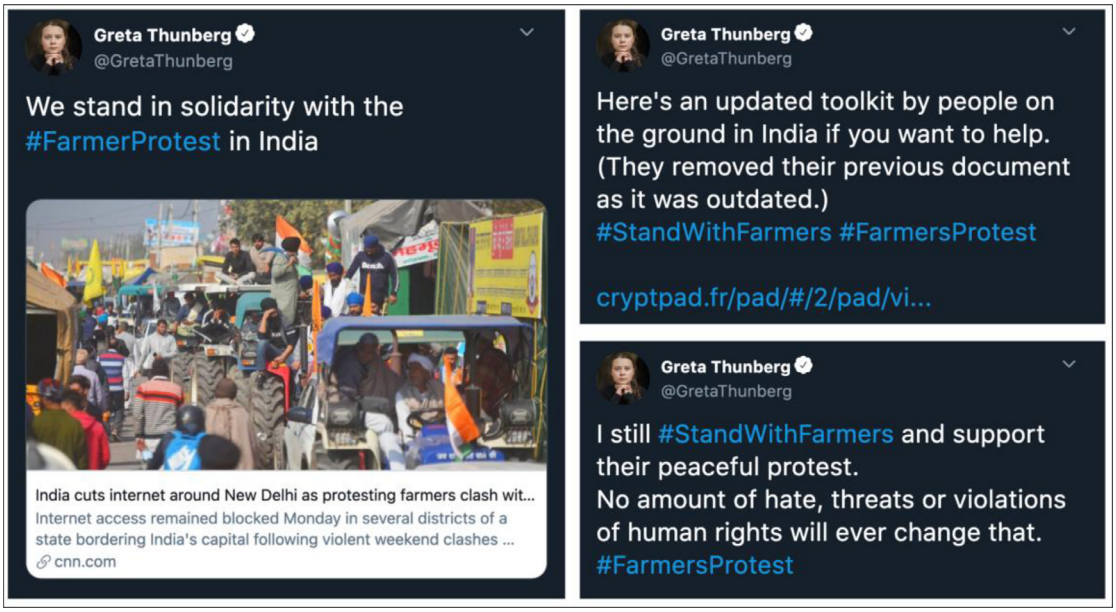


**Fig. 1.** Copy of Greta Thunberg's Tweets about the Indian Farmers' Protest.
*Note*: these tweets were also shown to participants in the exposure and image-prepare conditions.

tion on climate change. We also examine whether these negative consequences are concentrated among a particular political faction (protest opposers in this case), further polarising the climate movement. We then study if the public can be inoculated against attacks to Thunberg's image through image "prepare", a combination of image-repair and prebunking strategies proposed by Compton (2016). Findings from this research shed light on how climate activists' involvement in other social issues impacts the climate movement, and how potential negative effects can be addressed through image prepare.

### *1.1. Polarisation amongst protest opposers vs. supporters*

While it is possible that the farmers' protest united Indians in some respects, public attitudes about the protest were strongly polarised on political grounds (Chhokar, 2021). Protest opposers and supporters likely differed in their political preferences (with opposers supporting the ruling party), and viewed one another as political outgroups (Dash et al., 2021). Therefore, upon reading Greta Thunberg's tweets supporting the farmers' protest, those who oppose the protest (protest opposers) may perceive Thunberg as a member of their political outgroup.

In polarised contexts, the judgements people form about others, even on 'non-political' matters, are guided by political cues. For example, Republicans and Democrats judge students to be less deserving of an academic scholarship if they belong to their political outgroup rather than their ingroup (Iyengar and Westwood, 2015). Similarly, protest opposers may judge Thunberg to be less effective, even in the domain of environmental activism (unrelated to the farmers' protest), because she belongs to their political outgroup (i.e., protest supporters). By the same logic, protest supporters may find Thunberg to be more effective as an environmental advocate upon viewing her as part of their political ingroup.

Political figures' endorsement can also polarise public opinion on climate policies (Ehret et al., 2018). People often use the opinions expressed by political elites to infer group norms (Van Boven and Sherman, 2021). Polarisation is facilitated by people's desire to differentiate themselves from the prototypical or normative attitudes and actions of their outgroup and align more closely with their ingroup (Brewer, 1991). As a result, in order to differentiate themselves from their outgroup, people are especially inclined to take stances opposite to those endorsed by leaders of their political outgroup (Nicholson, 2012). So, to differentiate themselves from protest supporters, protest opposers may express lower intentions to take climate action because Greta Thunberg, a prominent protest supporter, endorses it.

### *1.2. The role of misunderstood motives and inoculation through image prepare*

Greta Thunberg's critics claimed that she tweeted in support of farmers because she wanted to incite violence and spread anti-national sentiments (Ellis-Petersen, 2021b). Research shows that people more readily attribute insincere ulterior motives when evaluating leaders from their political outgroup relative to leaders of their political ingroup (Munro et al., 2010). So, compared to those who support the farmers' protest, protest opposers are more likely to infer that Greta Thunberg's expression of solidarity was driven by insincere motives.

In the domain of climate change, the perceived motives of communicators in turn impact audiences' trust in them and willingness to engage in pro-environmental behaviour (Rabinovich et al., 2012). Studies also show that perceived inconsistencies between actions, values, and motives reduce the credibility of messengers like scientists and celebrities, who typically enjoy public trust (Sparkman and Attari, 2020). So, the extent to which people evaluate Thunberg's motives to be sincere may in turn determine how much they trust her as a climate advocate and how willing they are to take climate action.

The backlash Greta Thunberg received after her tweets can be seen as an attack on her image that may erode her effectiveness as a climate advocate. Image repair is a technique to restore a person's image *after* the attack (criticism of tweets, in this case) has taken place. Some ways to repair image are denial (denying that the person indeed took the action they are being accused of), bolstering (highlighting the actor's good traits e.g., their loyalty), transcendence (highlighting the person's virtuous values) and good intentions (clarifying that the person meant well i.e., was operating on sincere motives) (Benoit and Drew, 1997). These strategies have been used in various domains, such as to restore political figures' credibility (Dewberry and Fox, 2012; Liu, 2007).

A person's image may also be protected *before* the attack takes place, through inoculation. Following the biomedical analogy, psychological inoculation acknowledges threat to image i.e., the possibility of attack, raises weakened counterarguments (or attacks) and pre-emptively

refutes them before the attack (i.e., exposure to tweets) takes place (Mcguire and Papageorgis, 1961). The message used to acknowledge and pre-emptively refute threat before the attack is called a pre-bunk (Lewandowsky and van der Linden, 2021). Therefore, pre-bunks (or pre-emptive refutations) are the messages used to inoculate individuals against future threats. By demonstrating how (and why) potential threats may be refuted, pre-bunking is able to confer attitudinal resistance against a broad range of future attacks (van der Linden et al., 2021).

Evidence comparing image repair (restoring image *after* attack) and inoculation (refuting threat *before* attack) strategies in protecting individuals' image remains inconclusive. On the one hand, studies find inoculation to be more effective than image repair in protecting the image of products and manufacturers (e.g., Japanese cars or American television sets) from multiple attacks (Ivanov et al., 2009). However, by raising weakened attacks (that it subsequently counters), the refutational message used in inoculation can also make critiques of the person's image more salient and run the risk of weakening people's positive perceptions of the person in case no attack takes place (Wan and Pfau, 2004).

What if image repair and inoculation could be combined? Image prepare uses repair strategies (such as bolstering, good intentions, transcendence etc) to protect a person's image *before* the actual attack takes place. So, unlike image repair strategies that are used to restore a person's image *after* an attack has taken place, image prepare pre-empts threats to a person's image and refutes them *before* the attack. In this way, image prepare is an inoculation technique– it utilises image repair strategies as pre-emptive refutations (i.e., pre-bunks) to protect against future threats (Compton, 2016).

### 1.3. The present study and hypotheses

Although previous research has tested inoculation techniques in the context of public relations (such as to prevent customer dissatisfaction) (Compton et al., 2021), and identified potential image prepare strategies in prominent figures' conduct through case studies (Compton and Compton, 2018), it has not, to our knowledge, empirically evaluated image prepare as a strategy to protect a person's image. So, the present study is the first to empirically test image prepare as a strategy to inoculate against attacks to a public figure's (Greta Thunberg in this case) image. First, we hypothesised that exposure to Thunberg's tweets about the farmers' protest would lower receptivity to her climate advocacy and collective climate action intentions among Indians who oppose the farmers' protest. Second, providing an image prepare pre-bunk that clarifies Thunberg's motives prior to exposure to her tweets would mitigate the above negative effects. Third, the effects of both the attack (tweets) and image prepare pre-bunk on participants' receptivity to Thunberg's climate advocacy and their collective action intentions would be explained by the extent to which participants evaluate Thunberg's motives to be sincere.

## 2. Methods

This study was pre-registered. See Supplementary Information (SI) for deviations from pre-registration. Data and experimental treatments available. The research was approved by the Research Ethics Committee of the London School of Economics and Political Science (Reference number: 22758). A written informed consent was obtained from participants and no identifying information was collected.

### 2.1. Participants

Participants were Indian adults recruited via the online survey platform Cloudresearch. Consistent with pre-registered pre-screen criteria, those who had lower than working proficiency in English and/or reported being neutral (4= Neither support nor oppose) about the farmers' protest could not participate in the Study. Of those who completed the study, 38 participants were excluded from the analysis based on our a-priori exclusion criteria comprising attention check and seriousness check questions. As an attention check, we asked participants two factual questions about the tweets they read. Those who answered both questions incorrectly were excluded from the analysis. This enabled us to limit our sample to participants who paid attention to the tweets. We also asked participants if they had taken part in the survey seriously (seriousness check). Those who answered no to this question were excluded from analysis. See SI for further details on pre-screen and exclusion criteria.

The final sample comprised 541 Indian adults from 19 states and Union Territories ($M_{age}$= 32.27, $SD_{age}$=7.70; 144 females). 209 of which supported the Bhartiya Janata Party (BJP), 155 the Indian National Congress (INC) and 177 other parties. Since we recruited participants and collected data online, the smaller proportion of females (compared to males) in our sample is likely reflective of gender differences in internet access in India. A recent national survey found that 57% of Indian men, but only 33% of Indian women, have access to the internet (NFHS, 2022). Because reading tweets also requires internet access, the gender distribution in our sample is likely consistent with the proportion of Indian men and women who had access to Thunberg's tweets. Moreover, there were no significant gender-based differences in participants' perceived sincerity of Thunberg's motives ($p$=0.07), receptivity to Thunberg's advocacy ($p$=0.29) and collective climate action intentions ($p$=0.91). See SI section 4 for details.

Our a-priori, pre-registered power analysis showed that "535 participants are required to achieve 0.80 power in a ANCOVA (fixed effects, main effects and interactions) with a small-to-medium effect size ($\eta_p^2$= 0.03, 1- ß = 0.80, $\alpha$= 0.05, number of groups = 3, number of covariates = 1)" (Sabherwal, Shreedhar, et al., 2021). Along with this power analysis, we pre-registered our decision to recruit 800 participants to ensure sufficient sample size even if some responses (20% to 30%) had to be excluded due to issues with data quality. So, although our final sample had fewer participants than we had anticipated (see SI 7.2 for explanation), it was sufficiently powered for our primary analyses. Indeed, a post-hoc power analysis confirmed that our sample of 541 participants afforded a 96% chance (1-ß=0.96) of detecting a small-to-medium ($\eta_p^2$=0.03) interaction effect of condition (3-levels) and protest support (continuous) in an ANCOVA.

### 2.2. Experimental treatments

Participants were randomly assigned to one of three conditions. In the *exposure* condition, participants saw Greta's tweets in support of the farmers' protest (Fig. 1). In the *image-prepare* condition, participants first read a pre-bunk (pre-emptive refutation) followed by tweets from the *exposure* condition. In the *control* condition, participants saw tweets by unknown individuals unrelated to the farmers' protest and climate change. The survey was programmed such that participants had to spend at least 1-minute reading the tweets.

The pre-bunk message in the image-prepare condition first acknowledged the threat to Greta Thunberg's image by claiming that some Indians saw her actions in the farmers' protest as attempts to spread anti-national sentiments and incite violence. The message then employed two image-repair strategies to refute this threat—good intentions and transcendence (Benoit and Drew, 1997). First, it clarified Greta Thunberg's motives– claiming that her actions were driven by the desire to empower Indians to voice their demands to their government. Next, it described how her actions reflected Mahatma Gandhi's values of ahimsa (non-violence) and satyagraha (demand for truth).

### 2.3. Measures

See Table 1 for descriptive statistics and scale reliabilities.

**Table 1**
Intercorrelations, Descriptive Statistics, and Scale Reliabilities (N = 541).

| | *Age* | *Protest Support* | *Receptivity to Greta's Climate Advocacy* | *Collective Action Intentions* | *M (SD)* | *Cronbach's Alpha [95% CI]* | *Split-half reliability Spearman-Brown* | *>Omega [95% CI]* |
|---|---|---|---|---|---|---|---|---|
| *Age* | | | | | 32.27 (7.70) | - | | |
| *Protest Support* | -0.12** | | | | 3.98 (1.78) | | | |
| *Receptivity to Greta's Climate Advocacy* | -0.18*** | 0.38*** | | | 5.13 (1.49) | 0.93 [0.92, 0.94] | | |
| *Collective Action Intentions* | -0.12*** | 0.20*** | 0.49*** | | 5.55 (0.99) | 0.81 [0.78, 0.83] | | 0.84 [0.80, 0.87] |
| *Sincerity of Greta's Motives* | -0.10* | 0.39*** | 0.81*** | 0.40*** | 5.34 (1.32) | 0.87 [0.85, 0.89] | 0.87 | 0.91 [0.89, 0.93] |

*Note.* * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Correlation computed using Pearson-method.
Split-half reliability Spearman-Brown coefficient calculated for 2-item measures and Omega calculated for measures with more than two items.

#### 2.3.1. Protest support

Prior to viewing the tweets, participants reported the extent to which they supported or opposed the farmers' protest (1=strongly oppose to 7 = strongly support). Since protest support was a moderator of interest, those who neither supported nor opposed (4 on the Likert scale) the protest were not invited to proceed to the study. As pre-registered, we then recoded protest support into a 6-point Likert scale (1=Strongly Oppose to 6 = Strongly Support) to reflect that none of the participants in our final sample had expressed neutral support for the protest. Robustness checks found a similar pattern of results (as those reported in the results section below) when treating protest support as a 7-point variable (see Table S3 in SI, p.9).

After reading the tweets in their respective conditions, participants then responded to various measures, including outcome measures listed below.

#### 2.3.2. Receptivity to Thunberg's climate advocacy

Three items (1=Not at all to 7=Very much) asked participants how willing they were to learn from Greta Thunberg about climate change, trust the climate change related information she provides, and join a climate action campaign on her appeal. These items were adapted from the World Health Organisation's guide to effective advocacy (World Health Organization, 2006) and have been used in previous research investigating how people evaluate environmental actors (Sabherwal and Shreedhar, 2022).

#### 2.3.3. Collective climate action intentions

Participants reported their likelihood (1=Not at all to 7=Extremely), of taking four actions–signing a petition, making a social media post, donating, and volunteering for climate change mitigation efforts. This scale included items tested in previous research on collective action on climate change (e.g., Sabherwal et al., 2021). However, because the survey was conducted during the Covid-19 pandemic, we only included actions that could be performed in a socially distanced manner.

#### 2.3.4. Sincerity of Greta Thunberg's motives

Two items asked participants if Thunberg's actions were sincere (1=Very insincere to 7=Very sincere) and whether her actions were driven by good reasons (1=Strongly disagree to 7=Strongly agree). These items have been used in previous research on the credibility of environmental advocates (Sparkman and Attari, 2020).

Although the receptivity to Thunberg's advocacy composite was strongly correlated to perceived sincerity of Thunberg's motives ($r$=0.81, $p$<0.001; See Table 1), a confirmatory factor analysis using maximum likelihood estimation found good fit for a 2-factor model in which items measuring receptivity and sincerity corresponded to separate primary latent factors: RMSEA = 0.03 95% CI[0.001, 0.08]; CFI = 0.99, TLI = 0.99; SRMR = 0.01. Therefore, we were able to treat both composites as separate constructs in our analyses.

Besides the primary measures listed above and socio-demographic features, we also measured participants' susceptibility to misinformation, their motivation to defend their attitudes in the face of threat, the extent to which they were familiar with Greta Thunberg and with the Farmers' protest prior to the study, the extent to which they viewed the tweets they read in the survey as accurate, and the extent to which they were worried about Covid-19. We included these exploratory measures so that they could potentially serve as covariates. However, as reflected in SI (section 4), there were no significant differences between conditions on these constructs. Therefore, we did not control for any of the above measures in our analyses. See SI for details and differences across conditions on manipulation checks, socio-demographic variables, and potential covariates.

### 2.4. Analytic procedure

As pre-registered, first, we conducted an analysis of covariance (ANCOVA) to test if condition and protest support interacted to predict our primary dependent variables—participants' receptivity to Thunberg's climate advocacy and collective climate action intentions. In case of a significant interaction, we used Hayes' PROCESS (Hayes, 2017) Model 1 (moderation) to test if (a) the exposure condition lowered receptivity to Greta's climate advocacy and collective action intentions for those who oppose the farmers' protest, (b) the image prepare condition mitigated these effects of the exposure condition. Next, we used Hayes' PROCESS Model 8 (moderated mediation) to test if (c) perceived sincerity of Greta Thunberg's motives explained this interaction effect of condition and protest support.

## 3. Results

### 3.1. Receptivity to Greta Thunberg's climate advocacy

An ANCOVA found a significant main effect of protest support, $F(1,535)=94.37$, $p<0.001$, $\eta_p^2=0.15$ and interaction effect of condition and protest support $F(2,535)=7.82$, $p<0.001$, $\eta_p^2=0.03$. There was no significant main effect of condition ($p$=0.41). To further explore pairwise differences between conditions at various levels of protest support, we conducted moderation analyses using PROCESS.

**Table 2**
Moderation: Effects of Condition and Protest Support on Receptivity to Climate advocacy and Collective Action Intentions.

| | *Receptivity: Unstandardized Coefficient* | *Receptivity: Standardized Coefficient* | *Collective Action: Unstandardized Coefficient* | *Collective Action: standardized Coefficient* |
|---|---|---|---|---|
| **Exposure (1) vs. Control (0):** | | | | |
| *Condition* | | | | |
| | -1.20** | -0.40** | -0.53* | -0.27* |
| | [-1.92, -0.47] | [-0.65, -0.16] | [-1.03, -0.03] | [-0.52, -0.02] |
| *Protest Support* | -0.16 | -0.19 | -0.09 | -0.17 |
| | [-0.42, 0.01] | [-0.50, 0.12] | [-0.27, 0.08] | [-0.49. 0.15] |
| *Condition X Protest Support* | 0.32*** | 0.75*** | 0.13* | 0.45* |
| | [0.15, 0.49] | [0.36. 1.14] | [0.01, 0.24] | [0.05, 0.86] |
| *Condition at low Protest Support (M-1SD)* | -0.49* | -17* | -0.25+ | -0.13+ |
| | [-0.91, -0.08] | [-0.31, -0.03] | [-0.54, 0.04] | [-0.27, 0.02] |
| *Condition at high Protest Support (M + 1SD)* | 0.64** | 0.22** | 0.20 | 0.10 |
| | [0.23, 1.06] | [0.08, 0.36] | [-0.08, 0.49] | [-0.04, 0.25] |
| **Image Prepare (1) vs. Exposure (0):** | | | | |
| *Condition* | | | | |
| | 0.69* | 0.23* | -0.03 | -0.01 |
| | [0.002, 1.39] | [0.0001, 0.47] | [-0.53, 0.48] | [-0.27, 0.04] |
| *Protest Support* | 0.63*** | 0.76*** | 0.17+ | 0.31+ |
| | [0.38, 0.88] | [0.45, 1.06] | [-0.03, 0.34] | [-0.02, 0.64] |
| *Condition X Protest Support* | -0.15+ | -0.34+ | -0.01 | -0.03 |
| | [-0.31, 0.01] | [-0.71, 0.03] | [-0.12, 0.11] | [-0.43, 0.37] |
| *Condition at low Protest Support (M-1SD)* | 0.35+ | 0.12+ | | |
| | [-0.03, 0.74] | [-0.01, 0.25] | | |
| *Condition at high Protest Support (M + 1SD)* | -0.17 | -0.06 | | |
| | [-0.55, 0.22] | [-0.19, 0.08] | | |
| **Image Prepare (1) vs. Control (0):** | | | | |
| *Condition* | | | | |
| | -0.50 | -0.17 | -0.56* | -0.28* |
| | [-1.16, 0.15] | [-0.39, 0.05] | [-1.03, -0.09] | [-0.52, -0.05] |
| *Protest Support* | -0.01 | -0.01 | -0.08 | -0.15 |
| | [-0.25, 0.23] | [-0.30, 0.28] | [-0.25, 0.08] | [-0.46. 0.15] |
| *Condition X Protest Support* | 0.17* | 0.40* | 0.12* | 0.42* |
| | [0.02, 0.32] | [0.04, 0.76] | [0.01, 0.23] | [0.04, 0.81] |
| *Condition at low Protest Support (M-1SD)* | -0.15 | | | |
| | [-0.54, 0.25] | -0.05 | -0.31* | -0.16* |
| | | [-0.18, 0.08] | [-0.59, -0.03] | [-0.30, -0.02] |
| *Condition at high Protest Support (M + 1SD)* | 0..50* | 0.16* | 0.12 | -0.06 |
| | [0.09, 0.89] | [0.03, 0.29] | [-0.16, 0.40] | [-0.08, 0.20] |

*Note.* $^{+}$=$p$<0.10, =$p$ < .05, $^{**}$= $p$ < .01, $^{***}$=$p$ < .001.
Models are simple moderation model (PROCESS Model 1).
Conditional effects on low and high protest support only outlined when there is significant interaction between condition and protest support. Standardised estimates derived from linear models.

Coefficients (both unstandardised and standardised) for all moderation analyses (PROCESS model 1) are in Table 2 and for all moderated mediation analyses (PROCESS model 8) are in Table 3.

*3.1.1. Does exposure lower receptivity compared to control?*

Exposure lowered receptivity compared to control, $b$=-1.20 *95% CI* [-1.92, -0.47], *SE*=0.37, $t$=-3.25, $p$=0.001. Protest support significantly moderated this relationship, $b$=0.32 *95% CI* [0.15, 0.49], *SE*=0.08, $t$=3.79, $p$<0.001, such that among those who opposed the protest (M-1SD), exposure significantly lowered receptivity compared to the control condition, $b$=-0.49 *95% CI* [-0.91, -0.08], *SE*=0.21, $t$=-2.32, $p$=0.02. Whereas at high levels of protest support (M+1SD), exposure significantly increased receptivity compared to the control condition, $b$=0.64 *95% CI* [0.23, 1.06],*SE*=0.21, $t$=3.05, $p$=0.003 (Table 2, Fig 2).

*3.1.2. Does image prepare increase receptivity compared to exposure?*

The image prepare condition predicted higher receptivity compared to the exposure condition, $b$=0.69 *95%CI* [0.002, 1.39], *SE*=0.35, $t$=1.97, $p$=0.049. Protest support did not significantly moderate this relationship, $b$=-0.15 *95% CI* [-0.31, 0.01], *SE*=0.08, $t$=-1.86, $p$=0.06. This suggests that those who viewed the image prepare pre-bunk prior to viewing Thunberg's tweets were more receptive to her climate advocacy, irrespective of their level of protest support (Table 2, Fig. 2).

*3.1.3. Does image prepare mitigate the effects of the exposure condition, relative to the control?*

Unlike the exposure condition, the image prepare condition did not significantly lower receptivity compared to control (p=0.13). Protest support significantly moderated the effect of image prepare (vs. control) on receptivity, $b$=0.17 *95% CI* [0.02, 0.32], *SE*=0.08, $t$=2.21, $p$=0.03.

Further exploring this interaction, we found that like the exposure condition, image prepare increased receptivity (relative to the control) at high levels (M+1SD) of protest support, $b$=0.48 *95% CI* [0.09, 0.89], *SE*=0.20, $t$=2.40, $p$=0.02. And, unlike the exposure condition, image prepare did not significantly lower receptivity at low levels of protest support (M-1SD), relative to the control, $p$=0.47 (Table 2, Fig 2).

Therefore, the image prepare pre-bunk was able to mitigate the damaging effects of Greta Thunberg's tweets on protest opposers' receptivity to her climate advocacy.

*3.1.4. Does perceived sincerity of Thunberg's motives explain the effects of condition and protest support?*

Protest support significantly moderated the effect of exposure (relative to control) on perceived sincerity of motives, $b$=0.33 *95% CI* [0.19, 0.47], *SE*=0.07, $t$=4.56, $p$<0.001. Such that, at low levels of protest support (M-1SD), those in the exposure condition perceived Greta Thun-

**Table 3**
Moderated Mediation: Effects of Condition and Protest Support on Dependent Variables via Sincerity of Motives.

| | *Sincerity of Motives: Unstandardized* | *Sincerity of Motives: standardized* | *Receptivity: Unstandardized* | *Receptivity: Standardized* | *Collective Action: Unstandardized* | *Collective Action: Standardized* |
|---|---|---|---|---|---|---|
| **Exposure (1) vs. Control (0)** | | | | | | |
| Direct Effect | | | | | | |
| *Condition* | -1.38*** | -0.52*** | 0.10 | 0.03 | -0.13 | -0.06 |
| | [-1.99, -0.76] | [-0.76, -0.29] | [-0.33, 0.54] | [-0.11, 0.18] | [-0.61, 0.35] | [-0.31, 0.18] |
| *Protest Support* | -0.21+ | -0.28+ | 0.04 | 0.05 | -0.03 | -0.06 |
| | [-0.43, 0.01] | [-0.58, 0.01] | [-0.11, 0.19] | [-0.13, 0.23] | [-0.20, 0.14] | [-0.36, 0.24] |
| *Condition X Protest Support* | 0.33*** | 0.87*** | 0.01 | 0.02 | 0.03 | 0.11 |
| | [0.19, 0.47] | [0.49, 1.24] | [-0.09, 0.11] | [-0.22, 0.26] | [-0.08, 0.14] | [-0.28, 0.50] |
| *Sincerity of motives* | | | 0.95*** | 0.84*** | 0.29*** | 0.39*** |
| | | | [0.88, 1.02] | [0.77, 0.90] | [0.22, 0.37] | [0.29, 0.50] |
| *Index of Moderated-Mediation* | | | 0.31** | 0.19** | 0.10* | 0.09* |
| | | | [0.15,0.48] | [0.09, 0.28] | [0.04, 0.17] | [0.04, 0.16] |
| Indirect Effect via Sincerity of Motives | | | | | | |
| *At low Protest Support (M-1SD)* | | | -0.62*** | -0.21*** | -0.19** | -0.10* |
| | | | [-1.09, -0.16] | [-0.36, -0.05] | [-0.40. -0.04] | [-0.20, -0.02] |
| *at high Protest Support (M+1SD)* | | | 0.49*** | 0.16*** | 0.15** | 0.08** |
| | | | [0.21, 0.77] | [0.07, 0.25] | [0.06, 0.26] | [0.03, 0.13] |
| **Image Prepare (1) vs. Control (0)** | | | | | | |
| Direct Effect | | | | | | |
| *Condition* | -0.80** | -0.30** | -0.17 | 0.06 | -0.36 | -0.18 |
| | [-1.38, -0.22] | [-0.52, -0.08] | [-0.27, 0.61] | [-0.09, 0.21] | [-0.80, 0.09] | [-0.41, 0.05] |
| *Protest Support* | -0.08 | -0.11 | 0.06 | 0.07 | -0.06 | 0.11 |
| | [-0.29, -0.13] | [-0.40, 0.17] | [-0.10, 0.22] | [-0.12, 0.26] | [-0.22, 0.10] | [-0.41, 0.18] |
| *Condition X Protest Support* | 0.20** | 0.53** | 0.02 | 0.004 | 0.07 | 0.24 |
| | [0.07, 0.34] | [0.18, 0.89] | [0.10, -0.10] | [-0.24, 0.25] | [-0.04, 0.17] | [-0.13, 0.61] |
| *Sincerity of motives* | | | 0.84*** | 0.75*** | 0.25*** | 0.34*** |
| | | | [0.77, 0.92] | [0.68, 0.82] | [0.17, 0.33] | [0.23, 0.45] |
| *Index of Moderated-Mediation* | | | 0.17* | 0.10* | 0.05* | 0.05* |
| | | | [0.03, 0.30] | [0.02, 0.18] | [0.01, 0.10] | [0.01, 0.09] |
| Indirect Effect via Sincerity of motives | | | | | | |
| *At low Protest Support (M-1SD)* | | | -0.32 | -1.05 | -0.10 | -0.05 |
| | | | [-0.68, 0.05] | [-0.23, 0.02] | [-0.23, 0.02] | [-0.12, 0.01] |
| *at high Protest Support (M+1SD)* | | | 0.30** | 0.10 | 0.09* | 0.05* |
| | | | [0.04, 0.56] | [0.01, 0.19] | [0.01, 0.19] | [0.004, 0.09] |
| **Image Prepare (1) vs. Exposure (0)** | | | | | | |
| Direct Effect | | | | | | |
| *Condition* | 0.58+ | 0.22+ | 0.20 | 0.07 | -0.19 | -0.10 |
| | [-0.05, 1.20] | [-0.02, 0.46] | [-0.24, 0.65] | [-0.08, 0.22] | [-0.66, 0.29] | [-0.34, 0.14] |
| *Protest Support* | 0.57*** | 0.78*** | 0.14+ | 0.17+ | 0.01 | 0.02 |
| | [0.35, 0.80] | [0.47, 1.08] | [-0.03 0.31] | [-0.03, 0.37] | [-0.17, 0.19] | [-0.30, 0.34] |
| *Condition X Protest Support* | -0.13+ | -0.33+ | -0.04 | -0.09 | 0.03 | 0.09 |
| | [-0.27, 0.01] | [-0.70, 0.04] | [-0.14, 0.06] | [-0.32, 0.14] | [-0.08, 0.17] | [-0.28, 0.46] |
| *Sincerity of motives* | | | 0.85*** | 0.75*** | 0.28*** | 0.37*** |
| | | | [0.77, 0.92] | [0.69, 0.82] | [0.20, 0.36] | [0.27, 0.48] |
| *Index of Moderated-Mediation* | | | -0.11 | -0.07 | -0.04 | -0.03 |
| | | | [-0.25, 0.03] | [-0.15, 0.02] | [-0.09, 0.01] | [-0.08, 0.01] |
| Indirect Effect via Sincerity of motives | | | | | | |
| *At low Protest Support (M-1SD)* | | | | | | |
| *at high Protest Support (M+1SD)* | | | | | | |

*Note.* * = $p < .05$, ** = $p < .01$, *** = $p < .001$.
Models are moderated mediation models (PROCESS Model 8).
Conditional effects on low and high protest support only outlined when there is significant interaction between condition and protest support. Standardised estimates derived from linear models.

berg's motives to be less sincere compared to those in the control condition, $b$=-0.65 *95% CI* [-1.01, -0.29], $SE$=0.18, $t$=-3.60, $p$<0.001. Whereas at high levels of protest support (M+1SD) those in the exposure condition perceived Greta Thunberg's motives to be more sincere compared to those in the control condition, $b$=0.52 *95% CI* [0.16, 0.87], $SE$=0.18, $t$=2.87, $p$=0.004.

Perceived sincerity of Greta Thunberg's motives in turn significantly predicted how receptive participants were to her climate advocacy, $b$=0.95 *95% CI* [0.88, 1.02], $SE$=0.04, $t$=25.82, $p$<0.001.

A significant moderated mediation emerged, index=0.31, $Boot_{95\%CI}$[0.15, 0.48], $Boot_{SE}$=0.08, such that the indirect effect of the exposure (vs control) condition on receptivity, via perceived sincerity of motives was lower (and negative) among those who opposed protest (M-1SD), effect=-0.62, $Boot_{95\%CI}$[-1.09, -0.16], $Boot_{SE}$=0.23, compared to those who supported protests (M+1SD), effect=0.49, $Boot_{95\%CI}$[0.21, 0.77], $Boot_{SE}$=0.14 (Table 3).

Similarly, perceived sincerity of Greta Thunberg's motives also explained the interaction effect of the image prepare (vs control) condi-

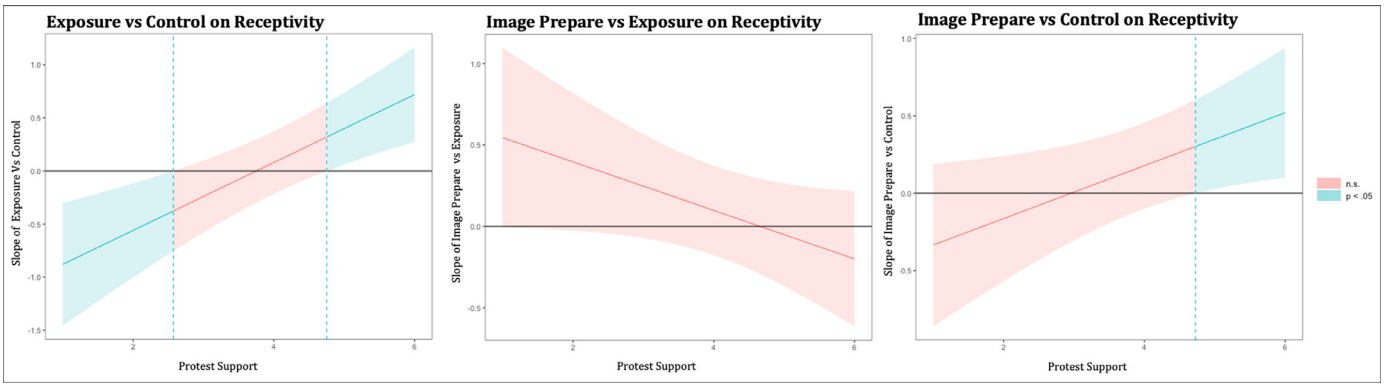


**Fig. 2.** Interaction Effect of Condition and Protest Support on Receptivity to Greta Thunberg's Climate Advocacy.
*Note.* [a] Plotted using Johnson-Neyman method.
[b] Plots show the effect of condition on receptivity to Greta Thunberg's climate advocacy among participants who report varying degrees of support for the Indian Farmers' protest.
[c] X axis is participants' support for the Indian farmers' protest measured on a 6-point Likert scale (1= Strongly oppose to 6=Strongly support). Y axis is the effect of condition, coded as a binary variable (Left-Right: 0=Control, 1=Exposure; 0=Exposure, 1=Image Prepare; 0=Control, 1=Image Prepare), on the extent to which participants rated Greta Thunberg to be an effective climate advocate, measured on a 3-item, 7-point Likert scale.

tion and protest support on receptivity to Thunberg's climate advocacy, index=0.17, $Boot_{95\%CI}$[0.03, 0.30] (Table 3).

Since protest support only marginally significantly moderated the effect of image prepare (vs exposure) on receptivity to Thunberg's advocacy, we did not expect perceived sincerity of Thunberg's motives to explain the interaction effect of condition and protest support on receptivity in this case. Indeed, Table 3 shows that moderated mediation (PROCESS model 8 with X = image prepare vs control condition, W = protest support, M = perceived sincerity of motives and Y = receptivity to Thunberg's climate advocacy) was non-significant, effect=-0.11, $Boot_{95\%CI}$[-0.25, 0.03], $Boot_{SE}$=0.07 (Table 3).

### 3.2. Participants' collective climate action intentions

An ANCOVA found a significant main effect of protest support, $F(1,535)=23.81$, $p<0.001$, $\eta_p^2=0.04$ and interaction effect of condition and protest support, $F(1,535)=3.17$, $p=0.04$, $\eta_p^2=0.01$. There was no main effect of condition ($p=0.63$). To further explore pairwise differences between conditions at various levels of protest support, we conducted moderation analyses using PROCESS model 1.

#### 3.2.1. Does exposure lower collective action intentions compared to control?

Exposure lowered collective action intentions compared to control, $b$=-0.53 *95% CI* [-1.03, -0.03], $SE$=0.25, $t$=-2.09, $p$=0.04. Protest support significantly moderated this relationship, $b$=0.13 *95% CI* [0.01, 0.24], $SE$=0.06, $t$=2.19, $p$=0.03. At low levels of protest support (1.22), exposure significantly lowered collective action intentions, $b$=-0.38 *95% CI* [-0.75, -0.001] $SE$=0.19, $t$=-1.97, $p$=0.05. Whereas at high levels of protest support (M+1SD), there was no difference in collective action intentions of those in the exposure and control conditions, $p$=0.17. (Table 2, Fig 3).

#### 3.2.2. Does image prepare increase collective action intentions compared to exposure?

There was no significant difference between the collective action intentions of those in the exposure and image prepare conditions ($p$=0.91). Moreover, protest support did not significantly moderate the effect of exposure (vs image prepare) on collective action intentions ($p$=0.87). So, image prepare did not increase collective action intentions compared to exposure.

#### 3.2.3. Does image prepare mitigate the effects of exposure?

Like the exposure condition, the image prepare condition also lowered collective action intentions compared to control, $b$=-0.56 *95% CI* [-1.03, -0.09], $SE$=0.24, $t$=2.37, $p$=0.02. Protest support significantly moderated this relationship, $b$=-0.12 *95% CI* [0.01, 0.23], $SE$=0.05, $t$=2.16, $p$=0.03. At low levels of protest support (M-1SD), image prepare lowered collective action intentions relative to the control, $b$=-0.31 *95% CI*[-0.61, -0.04], $SE$=0.14, $t$=-2.23, $p$=0.03. And at high levels of protest support (M+1SD), there was no difference between the collective action intentions of those in the image prepare and control conditions ($p$=0.39).

Exposure to Greta Thunberg's tweets (in both the image prepare and exposure conditions) lowered collective climate action intentions of those who opposed the farmers' protest (Table 2, Fig 3). Therefore, the image prepare condition did not mitigate the negative effects of the exposure condition on protest opposers' collective action intentions.

#### 3.2.4. Does perceived sincerity of Thunberg's motives explain the effects of condition on collective climate action intentions?

To address this question, we conducted a moderated mediation analysis using PROCESS model 8. Protest support significantly moderated the effect of exposure (relative to control) on perceived sincerity of intentions (Section 3.1.4).

Perceived sincerity of Greta Thunberg's motives in turn significantly predicted participants' collective action intentions, $b$=0.29 *95% CI* [0.22, 0.37], $SE$=0.04, $t$=-7.37, $p<0.001$. A significant moderated mediation emerged, effect=0.10, $Boot_{95\%CI}$[0.04, 0.17], $Boot_{SE}$=0.03. Such that, the indirect effect of the exposure (vs control) condition on collective action intentions, via perceived sincerity of intentions was lower (and negative) among those who opposed the protest (M-1SD), effect=-0.19, $Boot_{95\%CI}$[-0.40, -0.04], $Boot_{SE}$=0.09, and was higher (and positive) among those who supported the protest (M+1SD), effect=0.15, $Boot_{95\%CI}$[0.06, 0.26], $Boot_{SE}$=0.05.

A similar pattern of moderation by protest support and mediation via perceived sincerity of motives emerged when comparing the effects of image prepare and control conditions on collective action intentions, effect=0.05, $Boot_{95\%CI}$[0.01, 0.10], $Boot_{SE}$=0.02 (Table 3).

Since there was no difference between the collective action intentions of those in the image prepare and exposure condition, and no significant interaction between condition and protest support on collective action intentions in this case, we did not expect perceived sincerity of Thunberg's motives to explain the interaction effect of condition and protest support on receptivity. Indeed, Table 3 shows that

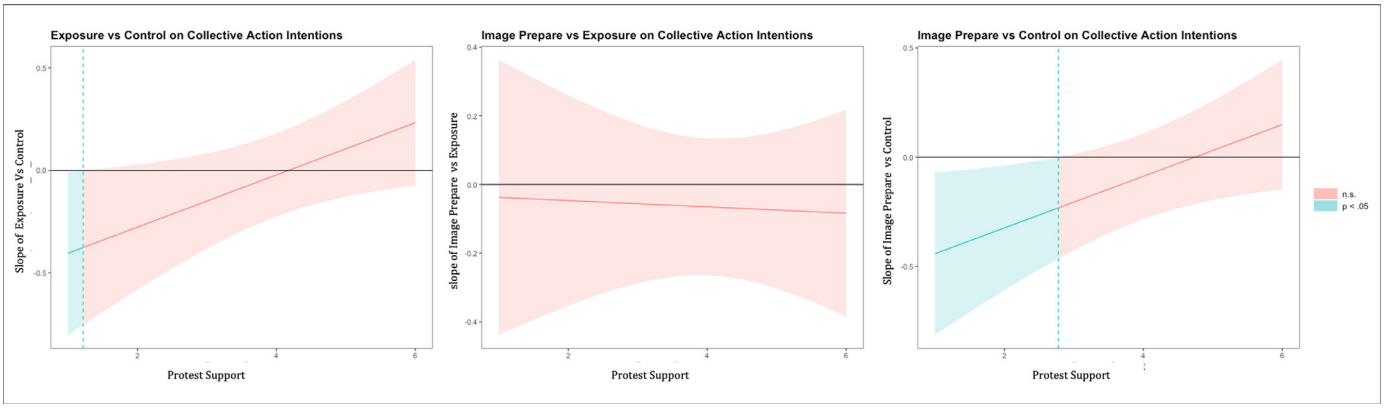


**Fig. 3.** Interaction Effect of Condition and Protest Support on Participants' Collective Climate Action Intentions.
*Note.* [a] Plotted using Johnson-Neyman method.
[b] Plots show the effect of condition on intentions to take collective climate action among participants who report varying degrees of support for the Indian Farmers' protest.
[c] X axis is participants' support for the Indian farmers' protest measured on a 6-point Likert scale (1= Strongly oppose to 6=Strongly support). Y axis is the effect of condition, coded as a binary variable (Left-Right: 0=Control, 1=Exposure; 0=Exposure, 1=Image Prepare; 0=Control, 1=Image Prepare), on participants' intentions to take collective climate action, measured on a 4-item, 7-point Likert scale.

the moderated mediation was non-significant, effect=-0.04, $Boot_{95\%CI}$[-0.10, 0.01], $Boot_{SE}$=0.03 (Table 3).

## 4. Discussion

We find that Greta Thunberg's support for the farmers' protest polarised the public's receptivity towards her advocacy– after reading her tweets, those who oppose the protest found her motives to be less sincere and in turn were less receptive to her climate advocacy, whereas those who support the protest found her motives to be more sincere and were more receptive to her. Protest opposers were successfully inoculated against threats to Thunberg's image using a pre-bunk that clarified her motives and values.

Protest opposers were also less willing to take collective climate action after reading her tweets. Contrary to our hypothesis, the pre-bunk was unable to mitigate these consequences on protest opposers' collective climate action intentions. However, this finding is consistent with how image prepare is conceptualised– as a strategy to protect an individual's image but not necessarily protect against any negative effects on larger social issues the individual may be connected with (Compton, 2016). Therefore, although the pre-bunk protected Thunberg's image, her tweets in support of the farmers' protest (even when accompanied with the pre-bunk) likely led protest opposers to view her as a prototypical member of their political outgroup. They may have then expressed lower support for climate activism–Thunberg's identifying feature–to differentiate themselves from what they viewed as a prototypical trait of their political outgroup (Brewer, 1991; Van Boven and Sherman, 2021).

That climate advocate's expression of cross-movement solidarity can polarise the public's response to climate change on political lines is especially concerning because climate change is not as politically polarised in India as in some Western countries like the US (Dubash et al., 2018). Since image prepare could not combat these polarising effects of Thunberg's tweets, other strategies may need to be adopted to mobilise climate action among Indians from various socio-political groups. Some climate change communication strategies such as highlighting how climate change can impact issues of national priority like economic growth and how it is affecting local communities may be able to mitigate these polarising effects by appealing to Indians across the political spectrum (Sabherwal and Kácha, 2021).

Although the exposure and image prepare conditions lowered protest *opposers'* collective action intentions, they did not enhance protest *supporters'* collective action intentions. This could be because whereas protest opposers viewed Thunberg as prototypical of their outgroup (a prominent figure who supports the farmers' protest), protest supporters did not view her as prototypical of their political ingroup. It is possible that protest supporters were familiar with several other local leaders (such as members of the Indian National Congress, Farmers' unions etc.) of the farmers' protest and therefore viewed Thunberg as just another in-group member rather than someone who was prototypical of their ingroup. In polarised contexts, individuals tend to distance themselves from actions and traits that are prototypical of their outgroup and align more closely with those that are prototypical of their ingroup (Brewer, 1991). So, upon reading a message that linked Thunberg with the farmers' protest, but did not directly advocate for collective action on climate change, or even the environmental implications of the farm law debate, protest supporters may have characterised Thunberg as an in-group member (and become more receptive to her climate advocacy) but did not feel a strong need to align more closely with Thunberg's action. As a result, their collective climate action intentions remained unaffected.

Although inoculation has been successfully used to counter misinformation in other contexts (van der Linden et al., 2021), our study is one of the first to empirically test its effectiveness in protecting an individual's image (Compton, 2016), as well as its implications on collective climate action intentions. We find that clarifying individuals' motives can protect their image from future attacks, even when public opinion is polarised. The underlying motives people attributed to Thunberg in the issue of the farmers' protest predicted their receptivity towards her in the unrelated domain of climate advocacy and people's engagement in climate action. Climate advocates' perceived motives may therefore be more impactful than previously thought (Rabinovich et al., 2012)– it seems that people use specific events to draw generalisations about an advocate's motives, which in turn impact the public's receptivity to them in other domains as well. Advocates could protect their image and ensure the public remains receptive to them by clarifying the underlying motives and values that drive their behaviour across various domains.

### 4.1. Future directions

Our findings suggest a discrepancy between how members of one's political ingroup and outgroup evaluate one's motives. Upon reading her tweets (exposure condition), protest supporters evaluated Thunberg's motives to be more sincere than did protest opposers. These evalua-

tions about Thunberg's motives in turn had implications for how receptive protest opposers and supporters were to Thunberg's climate advocacy. So, it is possible that climate change communication from political elites backfires because outgroup members negatively evaluate their motives. Future research on climate change communication in politically polarised contexts can investigate discrepancies between the motives observers attribute to members of their political ingroup and outgroup. Research can then identify the motives that, if signalled, can limit reactance.

Our image prepare pre-bunk not only utilised existing image prepare strategies– good intentions (clarifying the actor's motives) and transcendence (highlighting values), but it also created an association between Greta Thunberg and a prominent national figure, Mahatma Gandhi. Linking the actor to other virtuous figures might be a novel image prepare strategy which can be tested in follow-up research. Future research can also compare various image prepare strategies and understand which ones effectively protect environmental advocates' image.

Since intersectional environmentalism is gaining popularity among the new generation of activists (Oglesby, 2021), research can study the social psychological implications of this movement. For example, instead of commenting on the implications of the farm laws on climate change (what many perceive to be her expertise), Thunberg voiced support for protestors in a context (India) in which she is not perceived to have prior expertise. This could have suggested to some that she is willing to intervene on issues in which she has little prior knowledge, and therefore lowered her credibility (perceived sincerity) as an advocate. Therefore, Indians (including protest opposers) might have remained receptive to Thunberg's climate advocacy had she more clearly communicated the link between climate change (her expertise) and the farmer's protest (issue at hand). Future research can investigate how activists can effectively intervene in intersecting issues in which they are non-experts. Efforts should be made to identify how intersectional environmentalism may be harnessed to mobilise action among various social groups? And, how (and for whom) might it backfire.

### 4.2. Limitations

Since Thunberg's tweets were in English, we pre-screened for English language proficiency. Though fitting for our experiment, this restricted our sample to roughly 10% of the Indian population (Language, Census of India, 2011). Moreover, our study required internet access. Future research can expand the study of climate advocates' image and collective action to diverse groups of Indians (e.g., non-English speakers and those without internet access).

Since our study was conducted roughly 7 months after Thunberg tweeted in support of the farmers' protest, it is possible that some of our participants had already been exposed to her tweets. In this case, how could our image prepare message be considered an inoculation when the attack had already taken place? Although any item preceding our study and asking participants whether they had read Thunberg's tweets would have primed them, we did ask them how familiar they were with Greta Thunberg and with the farmers' protest (among other figures and events) prior to the study. Our analyses did not control for prior familiarity because there were no significant differences across conditions (See SI section 4). Moreover, research on the issue-attention cycle shows that the public and media tend to have short attention spans for issues relating to specific individuals and companies (Bodensteiner, 1995). Consistent with this, Google India searches for the terms "Greta Thunberg" and "Greta Thunberg Toolkit" peeked in Mid-February 2021 and relative public interest had declined to negligible by July-August 2021 (when this study was conducted) (*Google Trends*, n.d.). Therefore, it is possible that even if participants had seen the tweets in the past, they might not have actively recalled the tweets' content or felt strongly about them when the study was conducted. Finally, developments in *therapeutic* inoculation find that inoculation techniques need not be applied only to those who have no prior exposure to, or attitude about, an issue (Compton, 2020). In fact, inoculation messages in support of a position can modify the attitudes of those who might initially be neutral or opposed to the position, and protect these attitudinal gains from future attacks (Ivanov et al., 2017). So, our inoculation message may have persuaded even those with prior exposure to Thunberg's tweets to view her positively and protected this positive image from future attacks. Nonetheless, future research could empirically test image prepare strategies on fictional scenarios to eliminate the possibility of prior exposure.

### 4.3. Conclusion

Given that climate change is connected with other social issues, climate activists have adopted an intersectional approach that builds solidarity across various social movements and recognises how different social groups relate to climate change (Kaijser and Kronsell, 2014). With the advent of a new generation of activists and social justice movements (such as the Black Lives Matter movement), the understanding of intersectional environmentalism has expanded beyond simply acknowledging how different social groups relate to the climate crisis. Contemporary intersectional environmentalism opposes social inequity and advocates for social justice regardless of whether, or how closely, the issue is related to climate change (Oglesby, 2021). From an intersectional environmentalist lens, supporting Indian farmers during the farmers' protest is crucial not only because farmers are severely impacted by climate change, but also because the protest demands social justice– the right for farmers to shape legislation that will impact their livelihood.

Greta Thunberg's expression of support for Indian farmers is hence an instance of intersectional environmentalism, in so far as there was an effort to build an alliance between climate and non-climate activists. Conducted on a sample that remains underrepresented in psychological research (Rad et al., 2018), our study shows that expressing such solidarity toward one social movement can polarise public opinion on another, such as climate change. That polarisation around climate change occurs in an Indian setting is concerning, as climate change is relatively less politicised in India compared to western societies (Dubash et al., 2018). Since intersection with other social issues is inevitable, and even desirable to build cross-movement solidarity and climate awareness, our findings suggest that one way activists can protect against threats to their image is by clarifying their motives before engaging with diverse social movements.

## Declaration of Competing Interest

Given their role as an Editorial Board members, van der Linden S. had no involvement in the peer-review of this article and had no access to information regarding its peer-review. All other authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## CRediT authorship contribution statement

**Anandita Sabherwal:** Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Writing – original draft, Writing – review & editing, Visualization. **Ganga Shreedhar:** Conceptualization, Methodology, Investigation, Resources, Supervision, Writing – original draft, Writing – review & editing. **Sander van der Linden:** Conceptualization, Methodology, Supervision, Writing – original draft, Writing – review & editing.

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## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.cresp.2022.100051.

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