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Social norms and efficacy beliefs drive the Alarmed segment's public-sphere climate actions

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Surprisingly few individuals who are highly concerned about climate change take action to influence public policies. To assess social-psychological and cognitive drivers of public-sphere climate actions of Global Warming's Six Americas 'Alarmed' segment, we developed a behaviour model and tested it using structural equation modelling of survey data from Vermont, USA ($N = 702$). Our model, which integrates social cognitive theory, social norms research, and value belief norm theory, explains 36–64% of the variance in five behaviours. Here we show descriptive social norms, self-efficacy, personal response efficacy, and collective response efficacy as strong driving forces of: voting, donating, volunteering, contacting government officials, and protesting about climate change. The belief that similar others took action increased behaviour and strengthened efficacy beliefs, which also led to greater action. Our results imply that communication efforts targeting Alarmed individuals and their public actions should include strategies that foster beliefs about positive descriptive social norms and efficacy.

Anthropogenic climate change is being felt worldwide[1], yet the future magnitude of change and the nature of its effects will largely be shaped by governmental decisions[2]. Although it is important for individuals and organizations to reduce their carbon footprints[3], governments possess greater leverage for mitigation because they can implement policies that restructure choices available to millions of people and organizations. For example, governments can create mandatory carbon markets; incentivize or mandate certain behaviours, products, or technologies; reconstruct infrastructure; and finance large capital projects.

In any healthy democracy there is competition among interest groups to steer policy actions of local, state and national governments. The influence of oil companies and conservative foundations on American climate policy is well documented[4]. Citizens also wield considerable power. They can empower interest groups (through donations or volunteering), and they can directly influence governments to mitigate climate change (by voting, contacting elected officials, or protesting)[5,6]. These public-sphere climate actions can catalyse governmental action[5–7], yet little is known about the drivers of these behaviours. For instance, although there are a few empirical studies examining the predictors of public-sphere climate actions[8–11], research has focused on attitudes, beliefs, and perceptions about climate change[12,13] and private/household behaviours[14]. We undertook this study to advance our understanding of the drivers of public-sphere climate action.

Several theories posit that concern precedes action, and research supports the notion that concern is a driver of private behaviour[15,16]. Public-sphere actions, however, are not forthcoming from those most concerned about climate change. The Alarmed segment of the Global Warming's Six Americas (Fig. 1) is highly concerned. Alarmed individuals participate in relatively high levels of household and consumer actions to reduce climate change, but engage in much less public action[12,13,17]. For instance, during a 12-month period, only a third of the Alarmed donated money to organizations working to reduce climate change, and a mere 29% contacted government officials about climate change[12,13,17]. The juxtaposition between public actions inducing governmental response and Alarmed individuals not engaging in them led to our research question: What factors, in addition to concern, drive public-sphere climate action in the United States?

Other theories suggest that efficacy beliefs and descriptive social norms precede action[18,19]. Although these theories may provide insight into behaviour to limit climate change[20], they have rarely been applied in this context, particularly regarding public action. Here we examine if, how, and to what extent multiple efficacy beliefs and descriptive social norms influence public-sphere climate actions.

Public climate action model

We created and tested a behaviour model that integrates ideas from social cognitive theory (SCT)[18,21] and social norms research[19] into the value belief norm theory (VBN)[22] (see Fig. 2). For a detailed explanation of variables see Supplementary Information 1.

VBN as possible predictor of public-sphere climate action. Value belief norm theory (VBN) is a robust theory that has successfully explained individual private environmental behaviour, but has not been used to explain public-sphere climate actions. VBN proposes that personal norms drive behaviour, and that these norms are spurred by values, ecological worldview, awareness of consequences of environmental problems, and feelings of responsibility for the problem[15,22]. Supplementary Information 1 further explains variable relationships in VBN and our behaviour model.

The integration of multiple factors and theories within VBN enables it to be a strong predictor of environmental action[15,22]. However, more comprehensive behaviour theories are needed, and adding predictor variables to VBN such as efficacy and descriptive social norms should expand the model's abilities[22,23].

Efficacy beliefs and descriptive social norms. Bandura[24] argues that motivation to act is driven in part by beliefs that an action can produce desired results. Decades of research suggest that efficacy beliefs strongly influence private-sphere behaviours[18], such as littering[25], recycling[26], and conservation behaviours[27]. However,

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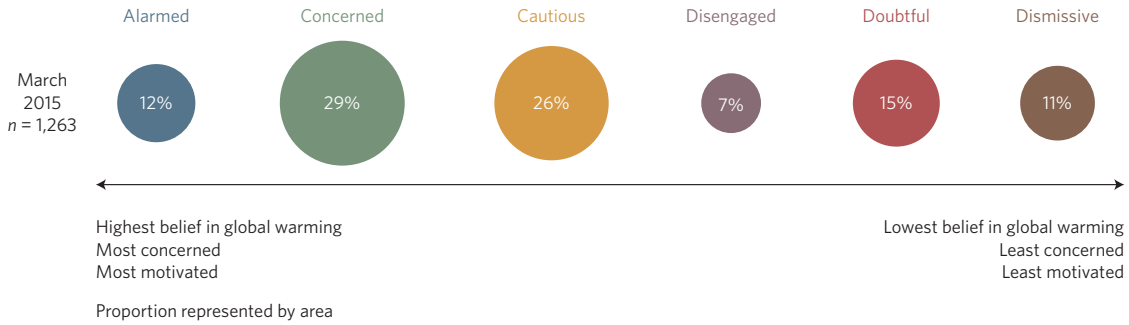

Figure 1 | Most recent 'Global Warming's Six Americas' segments in March 2015[50]. Figure reproduced with permission from ref. 50, Yale Univ. and George Mason Univ.

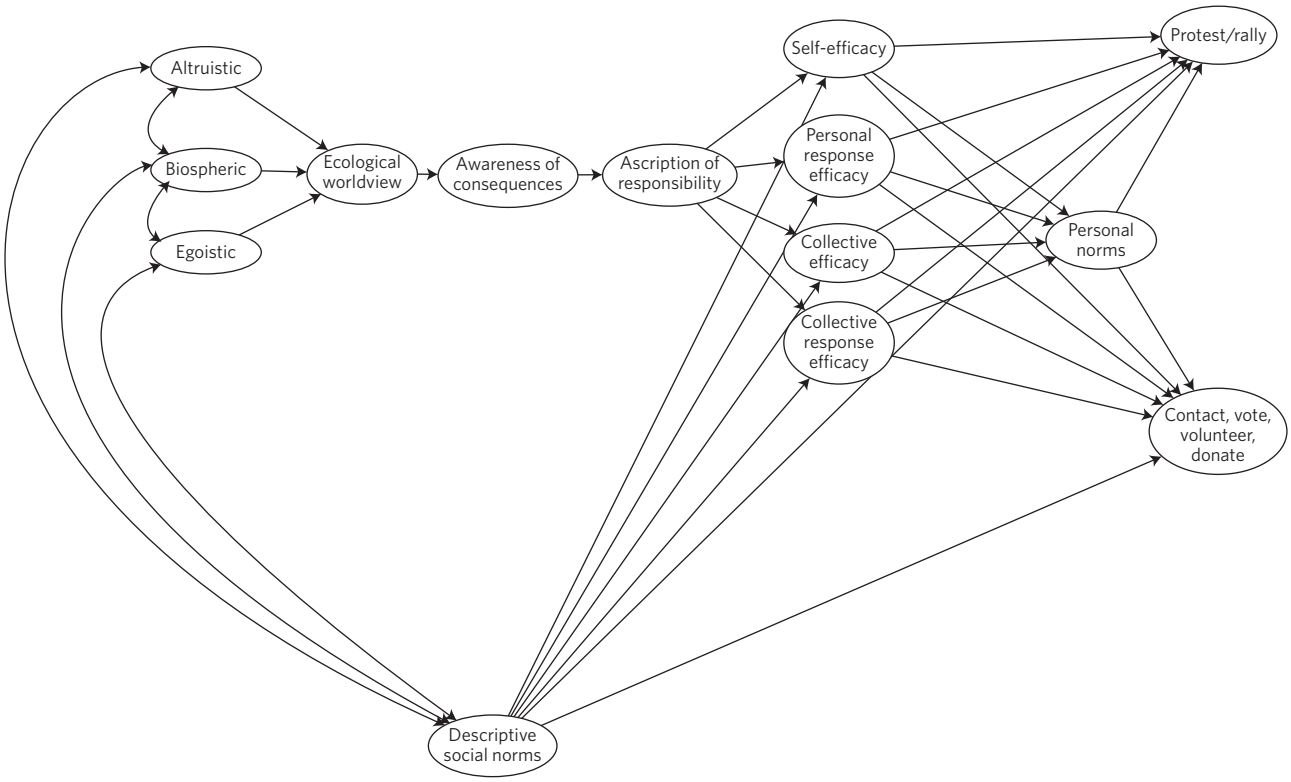

Figure 2 | Theoretical model of public-sphere climate action. In VBN theory, 'public-sphere behaviours' are distinct from 'private-sphere behaviours'. Within public-sphere behaviours, activism (that is, attending protests/rallies) is theoretically and empirically distinct from other public-sphere behaviours (that is, 'citizenship' actions—contacting government officials, donating time and money to organizations, voting)[15,22]. Thus, activism and citizenship behaviours are separate in our model. Altruistic, biospheric, and egoistic are value orientations. Efficacy beliefs are empirically distinct constructs.

little is known about how efficacy beliefs influence public-sphere climate actions. It is possible that public-sphere climate actions are partly driven by a calculus of efficacy beliefs that is different from that used in private-sphere behaviours[28].

Efficacy beliefs play a central role in SCT, which proposes that behaviours are influenced by people's assessments of their capability and perceived effectiveness of their actions[18]. SCT gives rise to the four empirically distinct types of efficacy in our model (see Table 1).

We postulate that public-sphere actions are driven by beliefs about capability and impact of action at both individual and group levels. Our model tests this by including all four efficacy variables. Existing behaviour theories and models that incorporate the notion of efficacy often contain only self-efficacy[29,30], although some include more[31,32]. Two models contain all four types of efficacy variables, but neither model focuses on actual behaviour, only intention to act[23] and organizational commitment[33]. Developing and testing a behaviour model containing each type of efficacy offers insight into which efficacy beliefs are the strongest drivers for particular public-sphere actions.

Social influences are also powerful forces on behaviour. Descriptive social norms (perceptions of what others do in similar situations[19]) are important predictors of private-sphere behaviours such as household energy conservation[14], hotel towel reuse[34], littering[19], and recycling[35]. Descriptive social norms provide a standard for behaviour, and we expect that public actions are just as susceptible to this standard as are private actions. Our model proposes descriptive social norms as an important predictor variable of public-sphere climate actions.

Clearly, efficacy beliefs and descriptive social norms are important catalysts for different behaviours in a variety of contexts[18,19]. However, these variables have rarely been empirically examined as drivers of public-sphere climate actions. We identified only four studies that empirically evaluate the impact of efficacy beliefs on public action to limit climate change[8–11]. None of the

Table 1 | Four forms of efficacy derived from social cognitive theory.

	Individual	Group
Capability	Self-efficacy—The belief that one is capable of taking action[20].	Collective efficacy—The belief that one's group is capable of acting together to perform its tasks[24].
Impact	Personal response efficacy—An individual's estimate that a given behaviour will lead to certain outcomes[21]. Bandura refers to this as outcome expectancy.	Collective response efficacy—Individuals' beliefs about the outcome or results of the group's work[33].

Table 2 | Action comparison of Vermont Alarmed sample and national Alarmed sample.

Public climate action	Vermont sample	National samples
Contacted government official	62%	29%[17] 26%[12]
Volunteered with an organization	45%	Volunteering and donating were conflated at 32%[12]
Donated money to an organization	63%	34%[17]
Voted for a candidate who supported limiting climate change	76%	No national data
Attended rallies or protests	30%	Attending community meetings and attending rallies were conflated for 14%[12]

Percentage reflects percentage of people who engaged in each action at least once in the twelve months preceding the surveys. Vermont Alarmed $n = 702$. Leiserowitz *et al.*[17] Alarmed $n = 189$. Maibach *et al.*[12] Alarmed $n = 383$.

studies includes all four types of efficacy or descriptive social norms. Although these studies differ in their efficacy definitions, the number and type of efficacy variables examined, and their ability to discern relationships between predictor variables, they reveal important information about what motivates general American audiences to engage in public-sphere climate action. The use of broad, non-segmented audiences, however, makes it difficult to determine what motivates those who are highly concerned.

In sum, there are very few empirical studies that examine drivers of public-sphere actions in the context of climate change. Even fewer empirical studies investigate the influence of multiple forms of efficacy and descriptive social norms on public climate action; and there are no known studies that examine these questions with an Alarmed audience. The present study contributes to existing literature by advancing our understanding of the drivers of Alarmed individuals' public-sphere climate actions through an examination of how descriptive social norms and multiple efficacy beliefs affect these actions.

Our model (Fig. 2) proposes that efficacy beliefs and descriptive social norms predict public-sphere climate actions for Alarmed individuals. In line with SCT[18] and other research[23], we expect efficacy beliefs to directly influence public-sphere climate actions and personal norms (sense of obligation to act). We expect descriptive social norms to directly predict behaviour and efficacy beliefs; and we expect efficacy beliefs to mediate the relationship between social norms and action[14,18]. For instance, beliefs that similar others perform an action should enhance perceptions that one is also capable of performing that action, which should increase action[21]. See Supplementary Information 1 for further explanation of variable relationships.

Model validation

Given our desire to understand the apparent inconsistency between alarm about climate change and public action to limit it, we targeted respondents in the Alarmed segment to test our model (see Supplementary Information 2). A total of 1,756 volunteer respondents completed our electronic survey. Fifteen questions from the Global Warming's Six Americas studies identified 702 Alarmed individuals, the focus of this study. To build a model with sufficient power, we selected Vermont because of its relatively high rate of citizen engagement. As expected, our sample participated in public climate actions at a higher rate than the national average (see Table 2). Supplementary Information 3 compares demographics.

Measurement model. The measurement model included all indicators of the latent constructs [$\chi^2 = 3{,}120.83(df = 879)^{***}$; RMSEA = 0.06; SRMR = 0.056; CFI = 0.89; the statistical terms are defined in the Data Analysis section of the Methods]. Based on confirmatory factor analysis (CFA) and other reliability and validity assessments (for example, internal consistency, indicator reliability, average variance extracted estimates, convergent validity, discriminant validity, multicollinearity and unidimensionality), the scales were purified through item removal and parcelling. CFA confirmed that there are four distinct efficacy constructs. The improved measurement model was a significantly better fit ($p < 0.001$) than the original measurement model [$\chi^2 = 2{,}033.67(df = 636)^{***}$; RMSEA = 0.06; SRMR = 0.06; CFI = 0.93]. See Methods and Supplementary Information 4 and 5 for measurement model details.

Theoretical model. Our theoretical model of public climate action was a good fit to the data [$\chi^2 = 2{,}145.17(df = 745)^{***}$; RMSEA = 0.05; SRMR = 0.09; CFI = 0.94]. It fitted the data better than eight competing nested models[36]. It was strongly predictive, explaining 64% of the variance in these four actions: contacting government officials in support of mitigating climate change; voting for candidates supporting climate change reduction; volunteering; and donating to climate change organizations. It explained 36% of the variance in attending protests about climate change mitigation.

Our model identified descriptive social norms as the strongest predictor for public-sphere climate actions, followed by self-efficacy, personal response efficacy, and collective response efficacy (see Table 3). Descriptive social norms also influenced self-efficacy ($\beta = 0.46^{***}$), personal response efficacy ($\beta = 0.44^{***}$), collective response efficacy ($\beta = 0.30^{***}$), and collective efficacy ($\beta = 0.15^{**}$). Self-efficacy ($\beta = 0.58^{***}$) and personal response efficacy ($\beta = 0.51^{***}$) were strong predictors for personal norms. In the preceding two sections, ** represents significance at α level 0.01 and *** represents significance at α level 0.001. See Supplementary Information 6 and 7 for all path coefficients.

Comparison of more active and less active Alarmed. Following Roser-Renouf *et al.*[37] we used the action of contacting government officials to separate our Alarmed sample into groups: 'more active' [contacted government officials during the 12 months preceding the survey ($n = 436$)] and 'less active' [no contact ($n = 266$)]. Of the more active respondents, 57% volunteered with climate organizations, 75% donated to such organizations, 80% voted partly based on climate change. For those who had a chance to protest, 41% participated at least once. Conversely, of the less active respondents,

Table 3 | Influence of efficacy beliefs and descriptive social norms on Alarmed individuals' public-sphere climate actions.

Path from this variable	Path to this variable: Contact, volunteer, donate, vote	Path to this variable: Protest/rally
Self-efficacy	$\beta = 0.16^{**}$	$\beta = 0.15^{**}$
Personal response efficacy	$\beta = 0.19^{***}$	$\beta = 0.14^{**}$
Collective efficacy	$\beta = 0.03$	$\beta = 0.01$
Collective response efficacy	$\beta = 0.17^{*}$	$\beta = 0.13^{*}$
Descriptive social norms	$\beta = 0.26^{***}$	$\beta = 0.20^{***}$

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

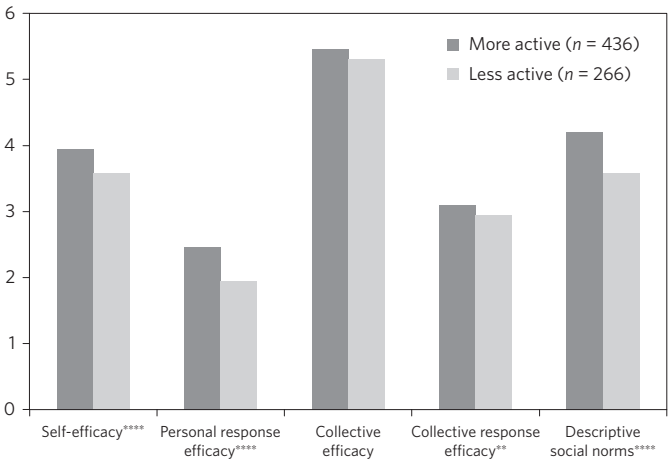

Figure 3 | Differences in efficacy and descriptive social norms constructs between Alarmed individuals who contacted government officials in the 12 months preceding survey and those who did not contact officials. **Significant at $p < 0.01$. ****Significant at $p < 0.0001$. Range of response options for self-efficacy was 1–5, personal response efficacy was 1-6, collective efficacy was 0–6, collective response efficacy was 0-6, and the range for descriptive social norms was 1–6.

27% volunteered with climate organizations, 42% donated to such organizations, 68% voted partly based on climate change. For those who had a chance to protest, 12% participated at least once.

Comparing key predictors of action between these groups, the more active respondents had significantly higher levels of descriptive social norms, self-efficacy, personal response efficacy, and collective response efficacy than less active respondents (see Fig. 3). The greatest magnitude difference between groups was for descriptive social norms.

Individuals who are geographically closer and similar to respondents were stronger social influences than those who are unfamiliar or distant. For instance, significantly more of the active Alarmed respondents reported that their friends and family were willing to engage in public-sphere climate actions than those of less active respondents (t (700) = 2.7, $p = 0.007$). Greater numbers of the less active group thought that unfamiliar or distant people (for example, 'most Americans') were more willing to engage in public-sphere climate actions; this belief could have led to the free-rider effect for the less active Alarmed.

In total, our theoretical model fitted the data well and strongly predicted public-sphere climate actions of Alarmed individuals. The strongest driver of action was descriptive social norms. Self-efficacy, personal response efficacy, and collective response efficacy beliefs were also important predictors. All of these beliefs had significant positive influences on public-sphere climate actions. Our Alarmed sample had high collective efficacy beliefs, but these did not motivate them to act. Those who acted did so because they believed similar others were acting, they trusted in their personal ability, and had confidence in the effectiveness of their individual and collective efforts.

Implications and applications

Results support causal assumptions depicted in our model: heightened efficacy beliefs and descriptive social norms of Alarmed individuals increase public-sphere climate actions. Although structural equation modelling does not prove causality, our results imply that communication efforts targeting Alarmed individuals and their public actions should include strategies that foster beliefs about positive descriptive social norms and efficacy. We offer the following approaches to reach this goal.

Increasing descriptive social norms. Descriptive social norms were powerful, positive, and direct influences on public-sphere climate actions and all efficacy beliefs. Strategies to elevate descriptive social norms include messages or experiences that highlight the prevalence of targeted actions by friends, neighbours, and other similar individuals[14,34,38]. Moreover, communication strategies that build 'opinion leadership' by encouraging those engaging in public climate actions to discuss their behaviour with others may heighten descriptive social norms, increase efficacy beliefs, and bolster action[8,39].

Enhancing efficacy beliefs. Self-efficacy, personal response efficacy, and collective response efficacy beliefs were direct, positive, and significant influences on action. Our model indicated that, in addition to efficacy beliefs being enhanced by descriptive social norms, higher values in the variable 'personal ascription of responsibility for causing climate change' increased self-efficacy, personal response efficacy, and collective efficacy beliefs. Thus, messages that heighten a sense of responsibility for causing climate change could elevate most efficacy beliefs. Specific efficacy beliefs are also influenced by other factors, as discussed in each efficacy section below.

Increasing self-efficacy. Self-efficacy beliefs can be strengthened through successful direct experiences, vicarious experiences, verbal persuasion, and a productive physiological state[29]. Out of these sources of efficacy, successful experiences are the most powerful, followed by vicarious experiences[29]. Hine *et al.*[38] found that Alarmed Australians' self-efficacy beliefs increased with messages providing specific climate adaptation advice and emphasizing local consequences. Self-efficacy has also been enhanced through opinion leadership[8], feedback[40], and increased knowledge[41].

Increasing personal response efficacy. Personal response efficacy beliefs can be heightened by demonstrating that individual engagement is important in achieving a collective goal[42,43]. Personal response efficacy beliefs can also be increased through information about consequences of climate change[23], threat-reducing actions[18], and opinion leadership[8].

Increasing collective efficacy. Leaders can influence feelings of personal and group identification, thereby increasing collective efficacy[44]. Building a sense of cohesion also contributes to collective efficacy[45]. Collective efficacy beliefs in our sample were high, but did not prompt action. However, we did not study other segments (see Fig. 1), and therefore cannot conclude that collective efficacy is unimportant as a driver of public-sphere climate actions for all people. For instance, collective efficacy predicted climate activism of a non-segmented sample[8], although the efficacy measure seems to combine collective efficacy and collective response efficacy.

Increasing collective response efficacy. In addition to being influenced by descriptive social norms and feelings of responsibility for contributing to the problem, collective response efficacy can be shaped by information about consequences of climate change[23], leadership[44], elite cues[46] and positive messages[47]. For instance, when uncertainty about the effects of climate change was presented in messages with a positive frame, people responded with stronger beliefs about the effectiveness of collective mitigation actions[47].

Our study reveals important social-psychological and cognitive predictors of public-sphere climate actions of Alarmed individuals. There are some caveats, however. For example, other personal forces (such as emotion and experience) and larger contextual factors (such as assessment of political climate) may also influence public actions but were not examined. Additionlly, policymaking is more than just the product of citizen pressure. We hypothesized unidirectional relationships between variables. With cross-sectional data, any potential feedback loops were not identified. It is possible, for example, that reciprocal relationships could exist between some efficacy beliefs and action. Future research could test our causal claims with experimental and longitudinal methods. It is possible that the actions of Vermont Alarmed respondents and motivating forces behind their behaviour differ from Alarmed people in other parts of the United States. However, audience segment is a better indicator of what people think and do about climate change than demographics such as state of residence[48]. Therefore, our results and subsequent implications should be externally applicable.

Contributions

Our results indicate that positive descriptive social norms and efficacy beliefs are strong motivational forces that drive Alarmed individuals' public-sphere climate actions. This is vital information because communication efforts often strive to increase concern about climate change under the assumption that concern prompts behaviour, yet the most concerned individuals are not necessarily taking action[17]. Indeed, one of the main challenges with the Alarmed segment is motivating them to engage in political action[49]. As suggested by our results, promoting beliefs about positive descriptive social norms and efficacy is a promising communication strategy for motivating Alarmed individuals to engage in public action.

Collective efficacy beliefs are already high for Alarmed individuals. This implies that communication efforts must move beyond messages such as 'We can do it' and focus on creating a shared sense of responsibility and strengthening self-efficacy, response efficacy, and descriptive social norms perceptions. Strategies to promote action include encouraging opinion leaders to exert influence within their social networks and beyond; messages that demonstrate similar others engaging in public climate actions; and persuading the Alarmed of the critical nature of their involvement and the effectiveness of their actions. Strategies meeting the following four objectives should help motivate Alarmed individuals to further engage in public actions: enhance beliefs about their ability to engage in public-sphere climate actions (self-efficacy); increase the notion that their individual actions are important contributions to the collective goal (personal response efficacy); heighten the belief that if we work together we will limit climate change (collective response efficacy); and convince people that friends, family, neighbours, and others similar to them engage in public-sphere climate actions (descriptive social norms).

This study advances our understanding of the motivations underlying Alarmed individuals' public-sphere climate actions. Researchers stress the importance of understanding and engaging specific segments of society[12,13,17,48], and recommend tailored ways to communicate with various segments to increase engagement[38,49], but few empirical evaluations identify key factors that motivate each group to act. Our study contributes to behaviour theory and communication strategies designed to encourage Alarmed citizens to further engage in public-sphere climate actions.

Methods

Methods and any associated references are available in the online version of the paper.

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Author contributions

K.L.D. conceived, designed, and implemented the research project, including survey development and administration and data collection and analysis/interpretation. T.N.W. provided advice on research design and survey development. K.L.D. wrote the manuscript with input from T.N.W.

Additional information

Supplementary information is available in the online version of the paper. Reprints and permissions information is available online at www.nature.com/reprints. Correspondence and requests for materials should be addressed to K.L.D.

Competing financial interests

The authors declare no competing financial interests.

Methods

Data were obtained by an author-created electronic survey conducted in Fall 2011. Based on information about the Alarmed segment's demographics, social characteristics, media use and information-seeking habits[12], we targeted Alarmed residents of Vermont, USA (see Supplementary Information 2 'Sampling'). Respondents were volunteers and completed the extensive survey without compensation. Approximately 60% of the 1,756 respondents were categorized as Alarmed. After listwise deletion, $N = 702$ Alarmed respondents.

Measurement

Structural equation modelling (SEM) assessed how well our proposed theoretical model accounted for the relationships among variables in our data. Latent variables in our theoretical model were estimated by a set of survey questions (that is, scale of observed variables). Our survey included the 15-item screener that determined a respondent's Six Americas segment[51]. Other scales were primarily author-created with exceptions noted below. Before officially launching the survey, it was edited based on responses from pretests and cognitive interviews. After this editing and after measurement model revisions, the final scales were:

Public-sphere climate actions. Public-sphere climate actions measured respondents' frequency of engaging in the following five actions in the 12 months preceding the survey: contacting government officials to urge climate change mitigation, voting for candidates supporting mitigation efforts, volunteering with or donating to climate organizations, and attending protests/rallies. The first four behaviours were measured on a five- or six-point scale ($\alpha = 0.65$). In line with the VBN theory[22], protesting was analysed separately, because this action is theoretically and empirically distinct from the other actions. See Supplementary Information 8 for more information.

Values. The value scale was based on de Groot and Steg's[52] value assessment, which was adapted from two previous value inventories[53,54]. Four Likert-type measures assessed altruistic values ($\alpha = 0.76$), three measures assessed biospheric values ($\alpha = 0.76$), and three measures assessed egoistic values ($\alpha = 0.58$). Response options were on a scale of 1–7.

Awareness of consequences. Seven questions derived from the Six Americas survey[51] assessed the extent to which respondents thought climate change would be harmful. Response options had a scale of 1–4 ($\alpha = 0.86$).

Ascription of responsibility for causing climate change. This was operationalized by three questions that asked respondents to rate their level of responsibility for contributing to climate change. Response options were on a scale of 1–6 ($\alpha = 0.83$).

Four types of efficacy. Self-efficacy was estimated through a five-part question: 'Please rate your capability to engage in these actions to reduce global warming: contacting government officials, voting, donating time, donating money, and attending rallies.' Response options had a scale of 1–5. Personal response efficacy's 13-question scale estimated perceived effectiveness of each respondent's actions and willingness to engage in those actions. Response options were on a scale of 1–5 ($\alpha = 0.78$). Collective efficacy's three-question scale estimated respondents' beliefs about the capability of others to engage in public climate action on scales of 1–5 or 1–6 ($\alpha = 0.64$). Collective response efficacy's 17-question scale measured beliefs regarding willingness and effectiveness of others' public climate actions. Response options were on scales of 1–5 or 1–6 ($\alpha = 0.89$). The four efficacy scales were empirically distinct from one another. See Supplementary Information 5 for correlations between efficacy constructs.

Personal norms. A seven-question scale tapped respondents' sense of personal obligation to engage in public climate actions on a scale of 1–5 ($\alpha = 0.85$).

Ecological worldview. This was measured, as per Stern *et al.*[22], with an abbreviated version of the New Ecological Paradigm scale. Three items were retained in the scale ($\alpha = 0.50$).

Descriptive social norms. This six-item scale estimated perception of how many people similar to respondents engaged in each public-sphere climate action. Response options were on a scale of 1–6 ($\alpha = 0.88$).

See Doherty[36] for detailed information on scale construction. Refer to Supplementary Information 9 for the survey instrument.

Data analysis

Data analyses were undertaken using the IBM PASW (SPSS) Statistics 20.0, and LISREL 8.80 programs. Analysis followed five stages:

(1) Segment identification.
(2) Data examination and preparation.
(3) Validation of the measures/testing the measurement models.
(4) Assessment and comparison of the structural path models (the theoretical models).
(5) Comparison of Alarmed 'more active' versus 'less active.'

Segment identification. Using the SPSS scripts that run the discriminant functions[51], responses to the first 15 questions in this study (that is, the segment identification tool) were analysed, and respondents were grouped into one of the Six Americas segments (see Fig. 1). A new data set was created using only the cases that belonged to the Alarmed group. This data set contained 880 responses.

Data examination and preparation. Once the data set was trimmed to only those respondents in the Alarmed segment, data were checked for accuracy, missing values, outliers, normality, multicollinearity and singularity. To determine if data were missing completely at random (MCAR), expectation maximization was used to compute Little's MCAR test[55]. Listwise deletion was used to remove any respondent that skipped one or more question. To confirm that the remaining sample was representative of the full sample, t-tests were conducted on pairs of variables. Nonsignificant results indicated there were no differences overall between those that completed the entire survey and those that did not. The remaining sample was 702. Frequencies were run on each of the variables to look for outliers. Means, standard deviations, kurtosis and skewness values were examined. There were no major problems with the normality of the data, and minor issues were addressed.

Validation of the measures/testing the measurement model. The measurement model defines the relationships between the latent variables and the observed variables. The structural path model (theoretical model) defines the relationships between latent variables. A test of the measurement model indicates whether the observed variables (survey questions) accurately and reliably measure the latent variables that make up the structural part of the model. This stage of data analysis, therefore, involved constructing measurement models and analysing the reliability and validity of the measures. We used the following reliability and validity assessments to determine consistency and accuracy of the measurement instruments: indicator reliability, scale reliability, composite reliability, average variance extracted estimates, convergent validity, discriminant validity, and unidimensionality. Refer to Supplementary Information 10 for definitions and descriptions of the reliability and validity assessments.

We created two measurement models. Both confirmed that the four efficacy constructs are empirically distinct. The original one was 'totally disaggregated,' thus each item from a scale was treated as an individual indicator of the latent variable[56]. The revised measurement model was 'partially disaggregated', therefore sets of items from a scale were combined to create indicators which are referred to as 'parcels'[56]. Parcelling is often used to reduce the complexity of the measurement model. The measurement models are depicted in Supplementary Information 4.

The original measurement model was assessed first using the reliability and validity tests outlined in the preceding paragraphs and Supplementary Information 10. The reliability and validity tests for the original model were acceptable, but some of the average variance extracted (AVE) estimates were low. Scale purification and parcelling were used to improve the measurement model. When purifying scales, items that did not measure a latent variable well were removed from the measurement scale for that latent variable. Specifically, items were removed if they: lacked unidimensionality; repeated another item that had a stronger relationship; or had a weak relationship with the latent variable. Where appropriate, items were parcelled. Parcelling often further improves the reliability and validity of the measurement model, because combining items can increase explanatory ability and decrease unexplained variance. The scale purification process and parcelling improved the reliability and validity values, AVE scores, and also increased the convergent and discriminant validity of the constructs. The revised measurement model was significantly more valid and reliable than the original one, and fitted the data better ($p < 0.001$). Therefore, we retained the revised measurement model for the analyses of the structural models.

Assessment of structural/theoretical models. Structural models stipulate relationships between the latent variables as suggested in theories and hypotheses. Once the measurement model indicated that the latent constructs were measured well, we examined the structural models to see how the latent constructs related, and how well the models reflected the data. We created eight structural models and tested those, plus the VBN theory, for a total of nine nested structural models.

To evaluate the extent to which the models can be considered an acceptable means of data representation, structural equation methodology uses a number of inferential and descriptive indices[57]. The model fit indices reflect how parsimonious the model is, how well the model represents the collected data, and how it compares to other competing models. We used the chi-square statistic as a model fit index. However, because the chi-square value is often significant with larger sample sizes, we also used the Comparative Fit Index (CFI), the Standardized Root Mean Square Residual (SRMR), the Root Mean Square Error of

Approximation (RMSEA), the normed chi-square, the chi-square difference test, and the Akaike's Information Criterion (AIC). We further examined relationship strength by reviewing the standardized path coefficients between latent variables. The model we present and discuss in this article fitted the data best and explained a substantial amount of the variance of each action [$\chi^2 = 2{,}145.17(df = 745)^{***}$; RMSEA = 0.05; SRMR = 0.09; CFI = 0.94].

Comparison of more active Alarmed and less active Alarmed. Following the focus of Roser-Renouf *et al.*[37] on the importance of contacting government officials to support climate change mitigation, more active and less active individuals in the present study were determined by the answer to Q16.1: 'How many times in the past 12 months have you...written letters, emailed or phoned government officials to urge them to take action to reduce global warming?' People who had engaged in that action once or more [a few times (2–3), several (4–5), many (6+)] in the past 12 months were considered 'more active'. Those who answered 'none' were considered 'less active'. This division was appropriate, as the mean for contacting officials was in the middle of all public action means. We used *t*-tests to assess significant differences between groups on efficacy constructs and descriptive social norms. For more detailed information about the methods employed in this study, see Doherty[36].

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