



## UvA-DARE (Digital Academic Repository)

### Climate change policy support, intended behaviour change, and their drivers largely unaffected by consensus messages in Germany

Tschötschel, R.; Schuck, A.; Schwinges, A.; Wonneberger, A.

**DOI**

[10.1016/j.jenvp.2021.101655](https://doi.org/10.1016/j.jenvp.2021.101655)

**Publication date**

2021

**Document Version**

Final published version

**Published in**

Journal of Environmental Psychology

**License**

CC BY

[Link to publication](#)

**Citation for published version (APA):**

Tschötschel, R., Schuck, A., Schwinges, A., & Wonneberger, A. (2021). Climate change policy support, intended behaviour change, and their drivers largely unaffected by consensus messages in Germany. *Journal of Environmental Psychology*, 76, Article 101655. <https://doi.org/10.1016/j.jenvp.2021.101655>

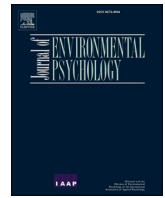
**General rights**

It is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

**Disclaimer/Complaints regulations**

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, P.O. Box 19185, 1000 GD Amsterdam, The Netherlands. You will be contacted as soon as possible.

*UvA-DARE is a service provided by the library of the University of Amsterdam (<https://dare.uva.nl>)*



# Climate change policy support, intended behaviour change, and their drivers largely unaffected by consensus messages in Germany

Robin Tschötschel<sup>\*</sup>, Andreas Schuck, Alexandra Schwinges, Anke Wonneberger

*Amsterdam School of Communication Research, University of Amsterdam, Nieuwe Achtergracht 166, 1018WV, Amsterdam, The Netherlands*

## ARTICLE INFO

### Keywords:

Gateway belief model  
Consensus messages  
Policy support  
Behaviour change  
Efficacy beliefs

## ABSTRACT

How can communication contribute to reducing greenhouse gas emissions through behaviour change and policy support? The existing literature emphasises informing people about the scientific consensus on climate change, but the underlying research has been conducted mainly in the US, where prior beliefs in human-made climate change are lower than in many other countries with the highest per-capita emissions. We test consensus messages in an ‘extended gateway belief model’ using a pre-registered survey experiment on a representative quota sample of the German population ( $N = 1171$ ). Our data show that consensus messages are likely to have no or only minimal effects on perceived scientific agreement, intended behaviour change and policy support. Still, in line with prior research, we find that perceived scientific agreement, belief in climate science, efficacy beliefs, and worry about climate change predict policy support and intended behaviour change. These results demonstrate that effective communication needs tailoring to its local context.

## 1. Introduction

What drives people’s willingness to engage with climate change, alter their behaviour, and support public policy to reduce greenhouse gas emissions? As climate change is making its impacts felt with growing forcefulness and further mitigation is becoming increasingly urgent over the current decade (IPCC, 2018), answering these questions is a crucial challenge for policymakers, activists, and scientists worldwide. The “gateway belief model” (van der Linden, Leiserowitz, Feinberg, & Maibach, 2015) offers an important insight, describing two associated phenomena: first, it states that “consensus messages” informing people about the actual 97%-level of agreement among climate scientists that climate change is happening and human-made (Cook et al., 2016) can trigger considerable changes in individual perception of the level of scientific consensus. Second, this change of perception acts as a “gateway belief” and leads to effects on key beliefs about climate science, worry about climate change, and ultimately support for public action.

While there is compelling evidence for the model’s predictions, including a large scale-replication in the United States (van der Linden, 2021; van der Linden, Leiserowitz, & Maibach, 2019), there are signs that consensus messages can be met with motivated reasoning and reactance. The available evidence is mixed, with some studies reporting

both reactance and “backfire” effects for some respondent subgroups (Cook & Lewandowsky, 2016; Ma, Dixon, & Hmielowski, 2018), some reporting evidence for reactance only (Chinn & Hart, 2021) while others find neither (van der Linden, Maibach, & Leiserowitz, 2019). Going in-depth with the resulting debate (Bayes, Bolsen, & Druckman, 2020; Dixon, Hmielowski, & Ma, 2019; van der Linden, Leiserowitz, et al., 2019) is beyond the scope of this paper. Overall, the bulk of evidence supports the notion that most message recipients alter their perceptions of scientific agreement towards the actual 97 % level of scientific consensus (Cook, 2019; van der Linden, 2021). However, most studies on the Gateway Belief Model and the effects of consensus messages were conducted in the US, the UK, Australia, and New Zealand, apart from one experimental study in Japan (Kobayashi, 2018) and correlational studies in Europe (Cook, 2019). This study adds to this body of evidence by experimentally testing consensus messages, with and without added political cues, in Germany. It also offers extensions to the original model, discussed in detail further below.

### 1.1. Intercultural differences

Why is there a need for additional evidence from non-anglophone countries, in particular continental European ones? Notwithstanding much lower per-capita emissions and being closer to their nationally

<sup>\*</sup> Corresponding author. University of Amsterdam, REC C8.02, Nieuwe Achtergracht 166, 1018WV, Amsterdam, The Netherlands.

E-mail address: [r.s.tschotschel@uva.nl](mailto:r.s.tschotschel@uva.nl) (R. Tschötschel).

determined contributions, like the United States, most other high-emission countries in Europe need additional efforts to achieve their Paris Agreement commitments (Roelfsema et al., 2020). Still, available studies point to considerable differences regarding extant beliefs about climate change and attitudes towards climate science and policy. For instance, while an increasing number of US adults agrees that climate change is happening and human-made, average levels of agreement lie around 60 % in the US (Leiserowitz et al., 2020a). This is considerably lower than in many European countries, where similar numbers in most countries lie above 90 % (Poortinga et al., 2018).<sup>1</sup> In addition, whereas belief in climate science and support for public action is strongly aligned with political leaning in the US (Leiserowitz et al., 2020b), in most European countries, the need to act on climate change can be considered a political consensus position (European Commission, 2019), typically only questioned by small radical-right wing parties.

These intercultural differences at the individual and political level are reflected in mediated reporting about climate science and politics. News recipients in the US are more frequently exposed to political information questioning climate science than in many other high-emitting countries (Painter & Ashe, 2012; Tschötschel, Schuck, & Wonneberger, 2020), even though these portrayals are often linked to journalistic evaluation (Brüggemann & Engesser, 2017). Research has shown that partisan selective exposure (Stroud, 2010) to “conservative” news sources is one of the key contributing factors to politicisation and polarisation around climate policy (Feldman, Myers, Hmielowski, & Leiserowitz, 2014; Gustafson et al., 2019; Hmielowski, Hutchens, & Beam, 2020). In contrast to the US, in many European countries, most news outlets are consumed more widely across the political spectrum (Newman, Kalogeropoulos, Nielsen, & Fletcher, 2019).

In summary, many continental European countries can be characterised as a “high-consensus” context, where, in comparison to countries like the US, the issue is less polarised and less frequently subject to public denial by political and opinion leaders. Consequently, the conversation has moved away from debating climate science and whether public action is needed and is instead focused on debating different solution strategies. One explanation for the effects of consensus messages in the US lies in their potential to reduce existing political polarisation surrounding the issue (van der Linden, 2021). Thus, the cross-country differences raise the question of whether consensus messages can have a similar impact in the high-consensus context typical of many other high-emission countries. In this study, we offer evidence from Germany, a typical case of this group.

### 1.2. Consensus messages, perceived scientific agreement and politicisation

First, we examine whether simple consensus messages (“97 % of scientists agree that human-made climate change is happening”) have considerable impacts on perceived scientific agreement and downstream variables. Notwithstanding the intercultural differences discussed above, we expect that this message will have an effect on perceived scientific agreement (hypothesis 1a) — albeit these are likely to be smaller than in the US or similar countries. In this study, we operationalise perceived scientific agreement as a latent variable, encompassing agreement on anthropogenic origins, as well as consequences and urgency.

The extant literature suggests that (political) identity can amplify or dampen the effects of consensus messages. Using “ingroup messengers”

<sup>1</sup> Survey wordings and scales differ slightly: the European numbers are based on an answer category stating that climate change is “at least partly” caused by humans, whereas the wording used by Leiserowitz et al. (2020a) is “mainly” caused by humans. At the other end of the scale wordings overlap: in the US 30 % answer that climate change is “mainly caused by natural causes”, whereas in most European countries, around 5 % choose the answer category with the same wording.

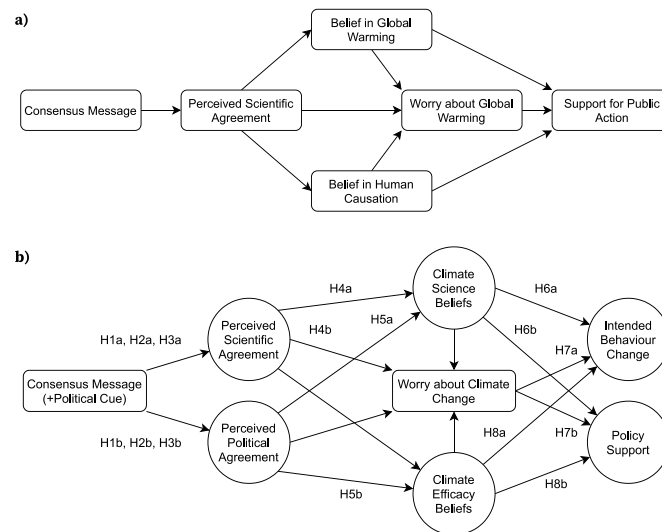
and identity cues can enhance the effects of pro-environmental and pro-climate messages, particularly for audiences previously politically opposed to mitigation policies (Fielding, Hornsey, Thai, & Toh, 2019; Goldberg, Gustafson, Ballew, Rosenthal, & Leiserowitz, 2019; Hurst & Stern, 2020). On the other hand, outgroup cues have, in some circumstances, been linked to adverse effects, leading audiences to abandon typically preferred policy options when in response to endorsement by outgroup leaders (Kousser & Tranter, 2018). As media analysis has shown, a large share of statements related to climate change (in particular policy) can be attributed to political actors, often politicians (Tschötschel et al., 2020), and real-world reporting often mixes scientific (consensus) information with political cues. We test whether such effects of political cues can be observed in the high-consensus context outlined, expecting positive effects for ingroup cues (hypothesis 2a) and dampening effects for outgroup cues (hypothesis 3a) of consensus messages on perceived scientific agreement.

### 1.3. A parallel gateway?

To further account for the differences in context, we offer a range of extensions to the original gateway belief model (Fig. 1). The core idea of the “extended gateway belief model” (see Fig. 1) is that consensus messages with political cues could unlock a parallel gateway that operates via perceived political agreement about climate science. Recent research has shown that perceptions of the social and political environment can affect how people think about climate change. For instance, perceived “social consensus” has been shown to “reduce ideological bias” about climate change (Goldberg, Linden, Leiserowitz, & Maibach, 2019; Lewandowsky, Cook, Fay, & Gignac, 2019) and perceptions of ingroup agreement with climate science can drive engagement with climate change (Ballew et al., 2020). We use the perceived level of political agreement with climate science — operationalised analogously to perceived scientific agreement — as a proxy for such social beliefs. We expect that consensus messages without political cues do not affect this variable (hypothesis 1b), while those attributed to ingroup politicians lead to stronger/positive effects (hypothesis 2b) and those attributed to outgroup politicians to weaker/negative effects on perceived political agreement (hypothesis 3b).

The extant literature shows that a combination of worry about climate change and efficacy beliefs are key predictors of information seeking, policy support and pro-environmental behaviour and behaviour intentions (Bradley, Babutsidze, Chai, & Reser, 2020; Chu & Yang, 2020; Hart & Feldman, 2016; Hornsey et al., 2015; Mead et al., 2012; Milfont, 2012). Nevertheless, the exact relationships between climate science beliefs, worry about climate change, and efficacy beliefs are not well established. Some studies suggest that efficacy beliefs are an outcome of risk perceptions, concern or worry about climate change (Bradley et al., 2020; Hornsey et al., 2015; Milfont, 2012). Others, often building on the extended parallel process model (Witte, 1992), argue that efficacy beliefs form in parallel with perceptions of threat or risk and have independent and interaction effects on behaviour, attitudes and other responses to climate change (Chu & Yang, 2020; Hart & Feldman, 2016; Mead et al., 2012). We follow this line of thought and model efficacy beliefs as a parallel mediator between perceptions and outcomes.

In line with the original gateway belief model, we expect perceived scientific agreement to predict climate science beliefs — here operationalised as a latent variable encompassing reality, anthropogenic origins, consequences for humans, and urgency of action — and worry about climate change (hypothesis 4a/b). Analogously, and in line with the discussion of social consensus effects above, we expect perceptions of political agreement to predict climate science beliefs and efficacy beliefs (hypotheses 5a/b). In addition, we explore the links between perceived political agreement and worry, and those between perceived scientific agreement and efficacy beliefs without directional hypotheses.



**Fig. 1.** Original and extended Gateway Belief Model linking exposure to consensus messages with intermediate and outcome variables

a) Conceptual depiction of the gateway belief model (van der Linden et al., 2015): following exposure to consensus message (treatment), changes in perceived scientific agreement act as a ‘gateway’ mediating changes in key beliefs and support for public action.

b) The extended gateway belief model informing this study, adding perceived political agreement and climate efficacy beliefs as ‘parallel’ gateway, predicting more complex outcomes. Note: circles depict latent constructs, boxes manifest variables.

#### 1.4. Policy support and intended behaviour change

While the original gateway belief model uses ‘support for public action’ as outcome measure, we instead look at intended behaviour change and policy support (for subsidies, taxes, and prohibitions) — both common in the literature on (consensus) message effects, perceived scientific agreement and climate science beliefs (cf. Cook, 2019; van der Linden, 2021). In high-consensus countries, the political and communication challenge no longer lies in garnering public support for the idea that climate change needs to be addressed. For instance, in Germany, the public discussion revolves around trying to agree on the right solutions to the problem (Tschötschel et al., 2020). The central challenge in many high-consensus countries is to move this discussion forward rather than generating general agreement that climate change needs public action. We expect our outcomes to be positively predicted by climate science beliefs and worry about climate change (hypothesis 6a/b and 7a/b) — in line with the original gateway belief model (van der Linden et al., 2015) — and by climate change efficacy beliefs (hypothesis 8a/b) — in line with the literature on efficacy beliefs and the extended parallel process model.

#### 1.5. Present study

This study presents evidence from a conceptual replication of the gateway belief model (GBM) in Germany. Despite general support for further public action on climate change, the country struggles with the timely implementation of its “Energiewende” energy transition (Quit-zow et al., 2016) and lags behind its emission-reduction goals. The country exhibits a robust public and political consensus on climate science (Poortinga et al., 2018), a historical track record of climate-friendly policies (Hake, Fischer, Venghaus, & Weckenbrock, 2015), and a public conversation about the issue focused on how to address mitigation and adaptation challenges (Tschötschel et al., 2020). We tested the predictions in line with our extended model in a pre-registered (<https://osf.io/7wszt/>) survey experiment ( $N = 1171$ ) using a highly representative quota sample of the German population.

## 2. Methods and materials

Methodologically as well as theoretically, this study builds on the

‘gateway belief model’ (van der Linden et al., 2015), which we extended with a range of additional concepts allowing us to investigate hypotheses we deemed pertinent to the high-consensus context described in section 1.1. As our extended gateway belief model relies on abstract concepts with multiple dimensions, we decided to use a latent variable structural equation model to account for this complexity — a key departure from the work done by van der Linden et al. (2015, 2019). Given the survey’s length and the pilot’s results showing less variance than in the US, we found it not feasible to measure difference scores (pre- and post-treatment) but rely on post-treatment between-group comparisons only. In a final methodological departure from the work done by van der Linden et al. (2015) and van der Linden, Maibach, et al. (2019), we made explicit to our respondents that the study aimed to investigate attitudes towards climate change (without revealing details about experimental treatments). Despite the differences to original gateway belief research (van der Linden et al., 2015, 2019), we argue that our work should be read as a conceptual replication of the original theoretical model<sup>2</sup> and a test of some extension hypotheses.

#### 2.1. Design and procedure

We used a Bayesian design that builds on the advantages of this statistical paradigm. In contrast to frequentist null-hypothesis testing, the results of Bayesian parameter estimation do not depend on the stopping or testing intentions (Kruschke & Liddell, 2018), allowing researchers to leverage a sequential sampling (Schönbrodt & Wagenmakers, 2018). Rather than distinguishing between evidence of an effect and the absence of evidence, Bayesian analysis allows designing a procedure differentiating directly between three states: evidence of a practically significant effect, evidence of its absence, and inconclusive (Kruschke, 2018). In a sequential design, researchers draw a first sample, analyse it and evaluate the state of the evidence. If the findings are

<sup>2</sup> In addition, our survey experiment incorporated the original survey items, allowing us to run an additional statistical analysis using manifest path analysis only, corresponding more closely to the operationalisation used by van der Linden, Maibach, et al. (2019). We report the methodological details and results of this analysis in Appendix D. Findings are in line with the results from the more elaborate analysis presented in the main text.

not conclusive, the sample is extended by drawing more data from a population with the same characteristics, and the analysis is repeated with additional statistical power due to the enlarged sample size, thus yielding more precise estimates. This process continues until the evidence is deemed conclusive for or against the hypotheses of interest (or a cut-off point is reached). In line with this approach, we specified in advance under which conditions we deemed the evidence conclusive for or against our hypotheses and under which circumstance we would move on to additional treatment conditions. We pre-registered this procedure, our overall design, and our hypotheses of interest in an Open Science Foundation registry (<https://osf.io/7wszt/>).

In a few instances, we needed to depart from our pre-registered analysis plan: First, we were able to extend our sample with additional respondents and adjusted our advancement and stopping rules to obtain a more balanced sample across conditions. Second, our measurement model excludes variable “be\_int\_5” (wrongly depicted in the pre-registration documents but not used in the pilot either). Third, we now number hypotheses in line with the flow of this document, departing from the numbering presented in the analysis plan (still, all hypotheses are included). Fourth, hypothesis 1a (6b in the pre-registration) now reads, “Simple consensus messages have an effect on *perceived scientific agreement*” rather than “on climate science beliefs” — an error in our pre-registration. As a final note, this article emphasises the “extension model”, but the “replication model” was analysed as well, with results reported in [Appendix D](#).

## 2.2. Survey, stimulus and measures

We conducted the survey experiment using Qualtrics software. After agreeing to an informed consent form, respondents answered a short array of demographic and political preference questions (full survey in [Appendix A](#)). Next, we presented our stimulus as introduction to the main survey, intending to hide the experimental manipulation from our participants. The stimulus ([Table 1](#)) consisted of four conditions and was shown on an otherwise empty screen. While very short, this brief statement aligns with the procedure described by [van der Linden \(2015\)](#) but could lead to relatively small observed effects (see Discussion in section 4 below). The political cue conditions were filled with the name of a politician associated with the party the respondent ranked as most preferred and a policy cue in line with the party’s program for the “ingroup” condition. For the “outgroup” condition, we selected the second-least preferred party and their policy position as cues, aiming to avoid this condition to be dominated by opposition to the “Alternative für Deutschland”, Germany’s radical right-wing party, and the only one publicly denying the reality of climate change.

Following the stimulus, we first asked participants about their perceptions of scientific agreement on climate change, followed by questions about perceived political agreement, climate science beliefs, individual, collective and political efficacy beliefs, emotions about climate change, behavioural intentions, and policy support (in this order). Each of these concepts was measured using a battery of three or more questions (see [Appendix C](#), [Table 4](#) for factor loadings, and

[Appendix A](#) for the survey items). Finally, respondents were debriefed and referred to the politician’s and their party’s energy-policy related websites, if applicable. The procedure and stimuli were reviewed by the University of Amsterdam’s ethics board under reference 2020-PCJ-12458. Before proceeding to statistical analyses, we removed low-quality results (“speeders” and “straightliners”) from the sample and standardised all observed variables.

## 2.3. Sample

Following a pilot ( $N = 100$ ) with the same sample characteristics as the main study to test our survey and operationalisation, we utilised eight independent batches of samples of the German population provided by Dynata throughout the period October 19–30, 2020. The first three batches of data were sampled to empirically investigate the observed variable model (see [Appendix D](#)), and we turned our attention to the latent variable SEM model with an initial  $N = 477$ . Batches 1 through 5 were assigned randomly to control and consensus conditions, while subsequent batches were used for in- and outgroup conditions. For all batches, nationally representative quotas were set on age and gender (interlocking), region and educational attainment (non-interlocking). The characteristics of the obtained sample approximate population characteristics for age, gender, political leaning (left-right self-position) and party preferences. In addition, across conditions, the sample is roughly balanced on these characteristics as well ([Table 2](#)). Most variation between conditions exists in terms of the relative proportions of most preferred party indicated by the respondent. Notably, this variation is strongest between control and consensus conditions, which were sampled in the same batches with true randomised assignment and are unlikely to differ systematically.

## 2.4. Statistical analysis

All statistical analyses were carried out using the R statistical computing environment. The Bayesian structural equation model was run using the R package ‘blavaan’ ([Merkle & Rosseel, 2018](#)). The R scripts used for analysis are published together with the dataset on the Open Science Foundation repository associated with this publication. Bayesian estimation uses three inputs: first, the model specifying the relationships between the variables to be analysed. Second, the observed data used to estimate values for parameters used in the model. Third, the so-called ‘priors’ that specify current beliefs about the possible and likely values these parameters could have. In this study, we used priors derived from our pilot data, reflecting the notion that priors should express current knowledge. While the selection of priors can have a considerable impact on parameters estimated using Bayesian SEM, this is mainly the case in small-sample studies ([Erp, Mulder, & Oberski, 2018](#)), unlike ours.

Before analysing the substantial results of the statistical modelling process, we checked for model convergence and stability ([Schoot, van Veen, Smeets, Winter, & Depaoli, 2020](#)). Finally, we evaluated model fit using SEM fit measures adapted for Bayesian analysis ([Garnier-Villareal](#)

**Table 1**  
Experimental condition stimuli.

Condition	Message
Control	Over the past year, the media has reported frequently on the subject of climate change. In the following, we would like you to answer a few questions about this topic.
Simple Consensus	Over the past year, the media has reported frequently on the subject of climate change. For example, there has been an increasing number of news reports that “97 % of climate scientists agree that man-made climate change is taking place”. In the following, we would like you to answer a few questions about this topic.
Political cue: ingroup and outgroup	Over the past year, the media has reported frequently on the subject of climate change. For example, [politician] was quoted as follows: “97 % of climate scientists agree that man-made climate change is taking place, and that is why [policy statement]”. In the following, we would like you to answer a few questions about this topic.

Politician names and policy statements can be found in [Appendix C](#).

**Table 2**  
Population and sample characteristics.

Variable	Population	Full Sample	Experimental Condition			
			Control	Consensus	Ingroup	Outgroup
Age <sup>a</sup>	44.5	49.1	49.1	48.7	50.0	48.5
% Men <sup>b</sup>	49.35	48.68	48.01	47.54	49.40	49.80
Political Leaning <sup>c</sup>	4.40	4.72	4.68	4.76	4.86	4.75
Party Preference (%) <sup>d</sup>	Die Linke	7	12.1	10.9	13.0	15.0
	Gruene	20	18.3	16.6	19.4	18.2
	SPD	17	16.4	17.9	15.1	18.1
	FDP	6	8.8	7.6	8.8	10.8
	CDU/CSU	36	29.6	30.5	27.8	28.0
	AFD	10	14.8	16.6	15.9	13.9
Batches		–	1–4	1–4	5–7	8
N		1171	302	284	332	253

<sup>a</sup> Statistisches Bundesamt Germany (Statistisches Bundesamt, 2020a), includes those under 18.

<sup>b</sup> Statistisches Bundesamt Germany (Statistisches Bundesamt, 2020b).

<sup>c</sup> Mean on left-right self-position scale. Population data from the European Social Survey, 2018 (European Social Survey, 2018).

<sup>d</sup> Face-to-face Poll by IfD Allensbach Oct 7–20 (Insitut für Demoskopie Allensbach, 2020). Pollsters include an “Other” category for parties currently not in parliament, and different pollsters’ results vary slightly throughout the period of investigation.

**Table 3**  
Fit indices for Structural Equation Model.

	RMSEA	$\Gamma^2$	$\Gamma^2_{adj}$	CFI	TLI	NFI
Mean	0.058	0.921	0.881	0.946	0.927	0.933
HDI	(0.057, 0.058)	(0.919, 0.923)	(0.879, 0.884)	(0.944, 0.947)	(0.925, 0.929)	(0.932, 0.934)

Point estimates and Bayesian posterior highest density intervals at the 0.95 level.

& Jorgensen, 2019) — Table 3 presents means and 95 % highest density (credible) intervals. We deem these fit indices to indicate sufficient fit for proceeding with a substantial analysis of model outcomes.

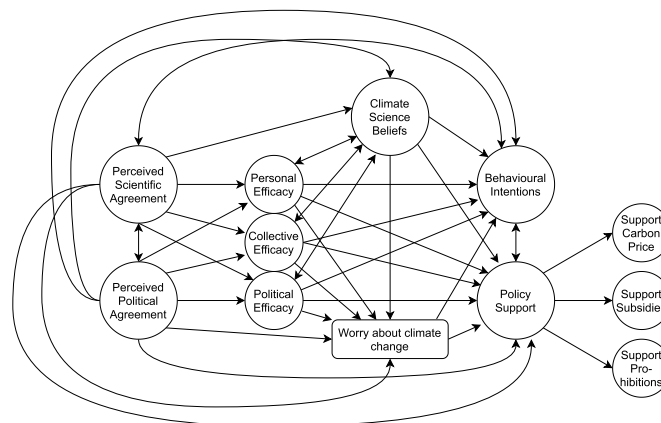
Bayesian estimation results in a posterior ‘sample’ of possible parameters, with a distribution corresponding to the fit to the data the parameters would produce (i.e., the distribution density is highest around the parameters producing the best fit). This posterior can be used to calculate both point estimates (posterior means) and ‘credible intervals’, usually operationalised as the highest density interval of the posterior sample distribution (Kruschke, 2018). Both these serve for further analysis and interpretation, with the advantage that they express probabilities for the parameters given data and priors.

While the statistical analysis yields these estimates for all statistical model parameters, including factor loadings, intercepts, and residual

variances and covariances (see Appendix C), we were mainly interested in the “structural” part of the structural equation model, the estimated regression (and covariance) relationships between the latent variables and (manifest) worry at the ‘core’ of the model (see Fig. 2). Taking inspiration from (Kruschke, 2018), we compare regression point estimates and credible intervals (HDI) to a “region of posterior equivalence” (ROPE) to 0, which we define as the interval (−0.1, 0.1). This procedure yields a heuristic to distinguish between evidence of an effect, inconclusive findings, and evidence for the absence of an effect.

- We claim strong evidence of an effect if the HDI is entirely outside the ROPE
- Evidence of an effect if the estimate is outside the ROPE, the HDI excludes 0, but the ROPE and HDI overlap
- Inconclusive evidence if the HDI contains 0, but the estimate is outside the ROPE
- Evidence of no effect if ROPE contains the point estimate, but the HDI exceeds it
- Strong evidence of no effect if the HDI is fully contained inside the ROPE

Arguably, these conditions put a strong requirement on finding an effect — very weak effects with good evidence do not qualify (e.g., an HDI ranging from 0.090 to 0.095), while these would likely yield



**Fig. 2.** Statistical model excluding latent variable measures

Note: Residual covariances between efficacy variables are not depicted but estimated. Measurement model for latent variables and treatment regressions (on all latent variables and worry) not depicted.

statistically significant results when using frequentist statistics. However, we argue that the bar for finding effects should include an element of practical relevance (i.e. a certain magnitude). Nevertheless, we report all relevant point estimates and their HDIs and leave it to the reader to decide whether they agree with our interpretation.

### 3. Results

#### 3.1. Climate change consensus treatments show little effects

Next to a control condition, we exposed respondents to three different consensus messages about climate change (methods section, 2). The first, directly adapted from van der Linden et al. (2015), simply informs respondents that “over the past year, media frequently report that ‘97 % of climate scientists agree that human-made climate change is taking place’”. Our data shows that this type of message is very unlikely to have substantially meaningful effects. Table 4 summarises observed means and standard deviations for key variables and experimental conditions (see Appendix B for a complete list). Note that the difference between “control” and “consensus” conditions for the “perceived scientific agreement” variable is statistically significant, but small,  $t(584) = 2.038, p = 0.04, d = 0.17$ . The same applies for the difference between “ingroup” and “control” conditions,  $t(632) = 2.593, p = 0.01, d = 0.21$ . Both these are considerably lower than the usual effect sizes reported in consensus messaging experiments — van der Linden, Maibach, et al. (2019), for example, reports an effect size of  $d = 0.88$ .

Turning to the structural equation model, as shown in Fig. 3 (and Appendix C, Table 1), effect estimates on perceived consensus and other variables are either close to 0 (or weakly negative). Given how well the German public is informed about climate change (Poortinga et al., 2018)

**Table 4**  
Means and standard deviations for key variables by experimental condition.

Variable	Experimental Condition			
	Control	Consensus	Ingroup	Outgroup
Perceived scientific agreement (psa_real 0–100)	71.13 (21.345)	74.84 (22.693)	75.48 (20.929)	73.47 (22.469)
Perceived political agreement (ppa_real 0–100)	63.81 (19.209)	64.51 (19.386)	65.76 (19.776)	64.27 (19.792)
Climate change is happening (csb_real 1–7)	5.44 (1.554)	5.39 (1.749)	5.6 (1.481)	5.38 (1.524)
Climate change human-made (csb_human 1–7)	5.81 (1.405)	5.86 (1.550)	5.87 (1.394)	5.72 (1.487)
Worried about climate change (cc_worry 1–7)	5.15 (1.633)	5.11 (1.698)	5.16 (1.528)	5.04 (1.651)
Support for public action (cc_action 1–7)	5.85 (1.238)	5.82 (1.483)	5.81 (1.350)	5.66 (1.379)
Mitigate climate change possible (eff_coll_1 1–7)	5.55 (1.408)	5.31 (1.689)	5.39 (1.544)	5.40 (1.533)
Climate-friendly behavior (be_int_1 1–7)	4.66 (1.973)	4.60 (1.930)	4.73 (1.845)	4.75 (1.834)
Support carbon price on fossil fuels (ps_tax_1 1–7)	4.36 (1.885)	4.29 (1.840)	4.27 (1.891)	4.14 (1.972)

Observed means and standard deviations. Full table in Appendix C. Survey questions in Appendix A.

and how little climate science is politicised in public discourse (Tschötschel et al., 2020), this is not entirely surprising.

Our statistical analysis reveals weak evidence in contrast to hypothesis 1a: simple consensus messages have no or minimal effects on perceived scientific agreement ( $\beta = 0.05, 95\%, \text{HDI} = [-0.02, 0.12]$ ).

This is in line with Kobayashi (2018), who found no effects of consensus messages in a non-anglophone country (Japan), but in contrast with most other research on the gateway belief model and consensus messages in the anglophone context. However, we want to caution readers that the direction of effect is positive. Our argument is chiefly that this effect is likely to be very small and of little relevance after a single exposure. In contrast to perceived scientific agreement, we expected to find evidence for the absence of an effect of simple consensus messages on perceived political agreement, and our analysis confirms this hypothesis 1b ( $\beta = -0.03, 95\%, \text{HDI} = [-0.10, 0.04]$ ).

Second, we exposed respondents to the same message but attributed the consensus statement to a politician from the party favoured by the respondent and combined it with a policy cue reflecting its position. In contrast to research in the United States, showing “ingroup messengers” and identity cues can enhance the effects of pro-environmental and pro-climate messages (Fielding et al., 2019; Goldberg, Gustafson, et al., 2019; Hurst & Stern, 2020), our German data shows that the differences between apolitical consensus messages and those adding ingroup cues are close to zero. We find strong evidence contradicting hypothesis 2a: ingroup political cues do not boost the effects of consensus messages on perceived scientific agreement ( $\beta = 0.03, 95\%, \text{HDI} = [-0.05, 0.10]$ ). On the other hand, our data are weak evidence for hypothesis 2b: using ‘ingroup’ political messengers (politicians affiliated with the respondent’s preferred party) does seem to boost perceived political agreement ( $\beta = 0.1, 95\%, \text{HDI} = [0.02, 0.18]$ ).<sup>3</sup>

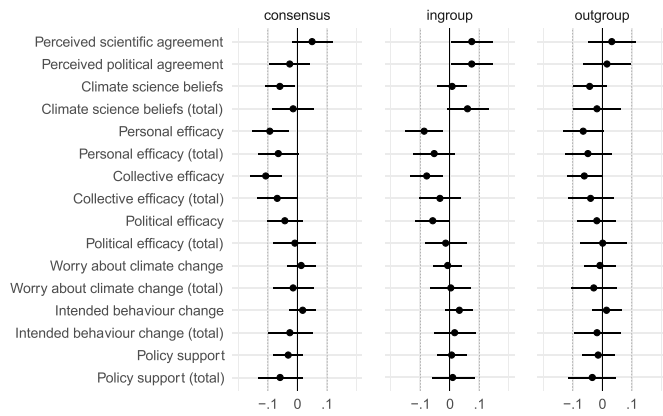
Finally, we tested the effects of political outgroup cues — using the same message, but this time with a politician and policy proposal from a party opposed by the respondent. In the extant literature, there is little and contradictory evidence about the effects of outgroup messaging. For instance, Australian political partisans responded to outgroup cues with lower levels of support for otherwise preferred policy options (Kousser & Tranter, 2018). On the other hand, in a recent experiment in the United States, conservative framing and messengers did not become less persuasive to liberal respondents (Hurst & Stern, 2020). Our data show that the effects of messages with outgroup cues are close to 0. We find strong evidence against hypothesis 3a — outgroup political cues do not boost the effects of consensus messages on perceived scientific agreement ( $\beta = -0.02, 95\%, \text{HDI} = [-0.10, 0.06]$ ) — and weak evidence against hypothesis 3b: outgroup cues do not dampen the effects of consensus messages on perceived political agreement ( $\beta = 0.04, 95\%, \text{HDI} = [-0.04, 0.12]$ ).

Overall, it appears that in the German high-consensus context with little political and public polarisation surrounding climate change, prior beliefs and attitudes towards climate change and climate policy are not susceptible to considerable change by exposure to simple text-based statements to possibly well-known scientific and political information about the issue. Whether the effects of consensus messages could be boosted, for example by using visual information, other enhancing strategies, or ingroup messengers other than political party members, remain open questions. An explorative look at the observed latent variable means by political preference (Fig. 4) shows that the appropriate strategy might differ from party to party. For instance, for the far-right Alternative für Deutschland, the ingroup condition seems most promising, whilst many other respondents seem to prefer simple consensus messages (without political information), and some subgroups even showing signs backlash effects or reactance to some of the conditions.

#### 3.2. No parallel gateway

The second core hypothesis of the gateway belief model states that the effects of consensus messages are fully mediated by ‘perceived

<sup>3</sup> Note that these estimates (and those in the following paragraph) use the “consensus” condition as comparison, while Fig. 3 depicts differences to the control condition.



**Fig. 3.** Effects of consensus messages per treatment condition  
Standardised regression coefficient point estimates and Bayesian credible intervals at the 0.95 level as horizontal lines. Vertical dashed lines indicate the (-0.1, 0.1) region of posterior equivalence to 0 (see methods section).

scientific agreement’ in a first step and individual climate science beliefs and worry in a second mediation step (van der Linden et al., 2015). We complemented this notion by including perceived political agreement with climate science in the model, which we hypothesised to act as a parallel gateway predicting downstream variables, particularly efficacy beliefs. Following similar distinctions in the literature (Feldman & Hart, 2015; Verschoor, Albers, Poortinga, Böhm, & Steg, 2020), we differentiate between personal, collective, and political efficacy beliefs, each encompassing measures of self-efficacy and outcome expectancy (see Appendix A for survey items).

Our model estimates, presented in Fig. 5 and Fig. 6 (as well as Appendix C, Table 2), show relationships partly in agreement with, and partly contradicting our pre-registered hypotheses. On the one hand, perceived scientific agreement acts as expected and in line with prior research (van der Linden et al., 2015, 2019) by serving as a predictor of downstream variables. In line with our expectation (Hypothesis 4a), we find strong evidence that it is a predictor of climate science beliefs ( $\beta = 0.84$ , 95 % HDI = [0.80, 0.88], strong evidence). Yet in contrast to our hypothesis 4b, our analysis shows weak evidence that its effects on worry about climate change are fully mediated ( $\beta_{\text{direct}} = -0.03$ , 95 % HDI = [-0.11, 0.06] and ( $\beta_{\text{total}} = 0.59$ , 95 % HDI = [0.54, 0.69])). Next to climate science beliefs, efficacy beliefs play a substantial mediating role between perceived scientific agreement and worry (and other downstream variables). There is strong evidence that perceived scientific agreement predicts personal efficacy ( $\beta = 0.54$ , 95 % HDI = [0.48,

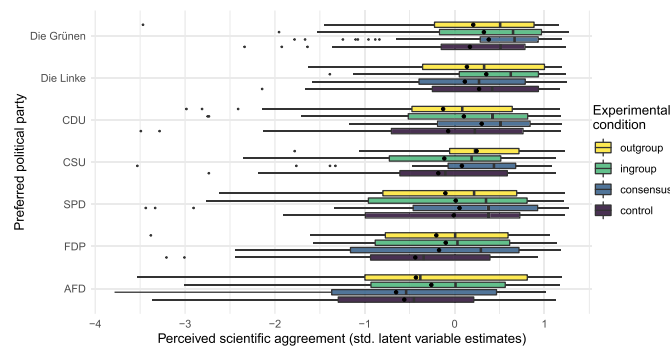
0.60]), collective efficacy ( $\beta = 0.72$ , 95 % HDI = [0.67, 0.77]), and political efficacy ( $\beta = 0.65$ , 95 % HDI = [0.60, 0.71]). Its relationship with intended behaviour change and policy support is fully mediated by these three variables (see section 3.3).

On the other hand, perceived political agreement does not seem to play a role independently of perceived scientific agreement. In contrast to our hypothesis 5a, there is weak evidence that it is a negative predictor of climate science beliefs ( $\beta = -0.12$ , 95 % HDI = [-0.19, -0.08]). Similarly, we find weak evidence that it does not predict personal efficacy beliefs ( $\beta = -0.08$ , 95 % HDI = [-0.15, -0.01]) or political efficacy beliefs ( $\beta = -0.06$ , 95 % HDI = [-0.12, 0.01]) and weak evidence that it predicts collective efficacy beliefs ( $\beta = -0.12$ , 95 % HDI = [-0.18, -0.06], weak evidence), in contradiction with our “parallel gateway” theory (hypothesis 5b). These findings may seem somewhat paradoxical, but we believe that explanation can be found when considering the strong residual covariance between perceived political and scientific agreement, estimated at 0.59 (95 % HDI [0.55, 0.63], Appendix C, Table 5). It appears that variation in perceived scientific agreement can explain most of the variation of downstream variables and perceived political agreement. Consequently, for most respondents, higher values of perceived political agreement are indeed positively associated with downstream variables. What little independent variation remains within perceived political agreement is, we think, mostly driven by a subgroup opposed to climate science and policy, thus producing the association. However, further research investigating such interactions is needed to explore this pattern, but beyond this article’s scope.

3.3. Behaviour intentions, policy support and their antecedents

Turning, finally, to the intended outcomes of consensus messaging, our findings show the advantages of distinguishing between behaviour intentions and policy support on the one hand and between beliefs about climate science and different efficacy beliefs on the other (Fig. 5 and 7). Confirming hypotheses 6a, 6b, 7a and 7b, we find strong evidence that beliefs about climate science serve as weak predictors of intended behaviour change ( $\beta_{\text{total}} = 0.31$ , 95 % HDI = [0.23, 0.39]) and moderate predictors of policy support ( $\beta_{\text{total}} = 0.4$ , 95 % HDI = [0.32, 0.49]). There is strong evidence that worry mediates this relationship ( $\beta = 0.43$ , 95 % HDI = [0.34, 0.51] and predicts intended behaviour change — it moderately predicts intended behaviour change ( $\beta = 0.2$ , 95 % HDI = [0.15, 0.26]) and weakly predicts policy support ( $\beta = 0.16$ , 95 % HDI = [0.11, 0.22]), in line with prior research on the gateway belief model (van der Linden, Leiserowitz, et al., 2019).

Turning to efficacy beliefs, our findings show strong evidence that personal efficacy beliefs are moderate positive predictors of intended behaviour change ( $\beta_{\text{total}} = 0.38$ , 95 % HDI = [0.30, 0.46]). In addition, there is weak evidence that they play a minor role in predicting policy



**Fig. 4.** Boxplots of standardised latent variable point estimates of ‘perceived scientific agreement’ by political preference  
Note: Vertical lines in the box indicate median values, points indicate means. Box from 25 % to 75 % percentile, whiskers at Median ± 1.5\*IQR. Parties sorted by average perceived scientific agreement.

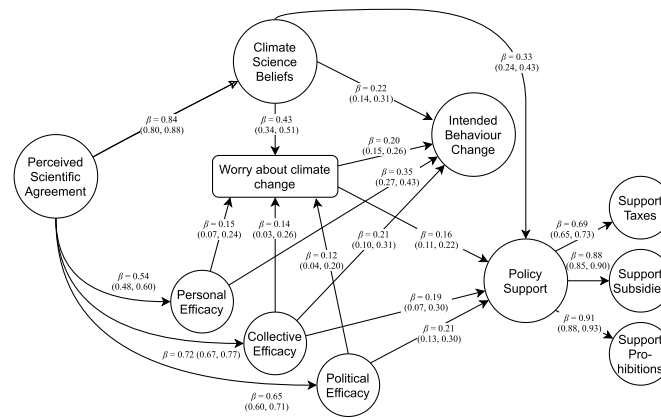


Fig. 5. Structural Equation Model regression results (variables with at least one non-zero coefficient path only)

Note: Standardised regression coefficient point estimates and Bayesian credible intervals at the 0.95 level. For ease of exposition, the following coefficients and variables are omitted: consensus treatment → collective efficacy  $\beta = -0.11$  (-0.16, -0.05); perceived political agreement → climate science beliefs  $\beta = -0.13$  (-0.19, -0.08); perceived political agreement → collective efficacy  $\beta = -0.12$  (-0.18, -0.06).

support ( $\beta_{total} = 0.11$ , 95 % HDI = [0.02, 0.20]). The reverse is true for political efficacy beliefs, with weak evidence that they do not predict intended behaviour change ( $\beta_{total} = 0.07$ , 95 % HDI = [-0.01, 0.15]) but strong evidence that they moderately predict policy support ( $\beta_{total} = 0.23$ , 95 % HDI = [0.15, 0.31]). Finally, we find strong evidence that collective efficacy beliefs act as moderate predictors for both ( $\beta_{total} = 0.21$  and 0.23, 95 % HDIs contained in = [0.10, 0.34]). Taken together, this is in line with our expectations that efficacy beliefs are a key factor in predicting policy support and intended behaviour change (Hypotheses 8a and 8b). These relationships are partially mediated by the weak positive association between efficacy beliefs and worry (weak evidence for all: average  $\beta = 0.14$ , all 95 %, HDIs contained in [0.03, 0.26]), meaning that there does not seem to be a trade-off between worry and efficacy.

To sum up, we see our results as evidence that climate science beliefs and efficacy beliefs do indeed appear to work in tandem, as suggested by the extended parallel process model (Witte, 1992). In addition, in contrast to the effects of consensus messages, the relationships between psychological constructs related to climate change appear to be invariant to the US and German context. Finally, worry can be a “constructive” cognitive response to climate change (Verplanken, Marks, & Dobromir, 2020), linked to political information seeking and learning (Yang, Rickard, Harrison, & Seo, 2014).

#### 4. Discussion

On the one hand, our results show that most relationships between beliefs and attitudes concerning climate change and climate policy are roughly transferable between the US and Germany. On the other hand, text-based climate change consensus messages (with or without added political cues) do not appear to have considerable effects on policy support, intended behaviour change or any of the constructs measured in our study, including perceived scientific agreement. While some of the measured coefficients are positive and might be relevant when recipients are exposed repeatedly, we view our data and analysis as initial evidence that consensus messages are likely less relevant in the German context and countries like it. It is noteworthy that this is despite not exceptionally high levels of perceived scientific agreement in the control group ( $M = 71.13$ , see Table 4). In our view, this indicates a kind of saturation effect, leading to audiences being largely unaffected by information they are relatively familiar with.

Our findings show, in our view, that climate change communication needs tailoring to the current state of the nationally specific conversation about climate change and adjustment to its specific aims and target groups. In Germany, and likely many other high-consensus countries with relatively widespread agreement on the need to fight climate change, the public conversation is relatively saturated with information regarding the topic. In this contemporary context, targeting perceived

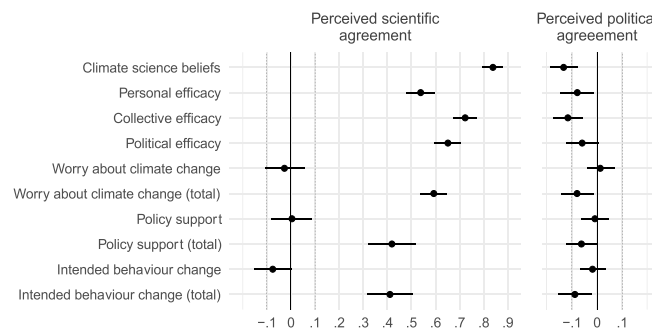


Fig. 6. Regressions from perceived scientific agreement and perceived political agreement predicting downstream variables

Standardised regression coefficient point estimates and Bayesian credible intervals at the 0.95 level as horizontal lines. Vertical dashed lines indicate the (-0.1, 0.1) region of posterior equivalence to 0 (see methods section).

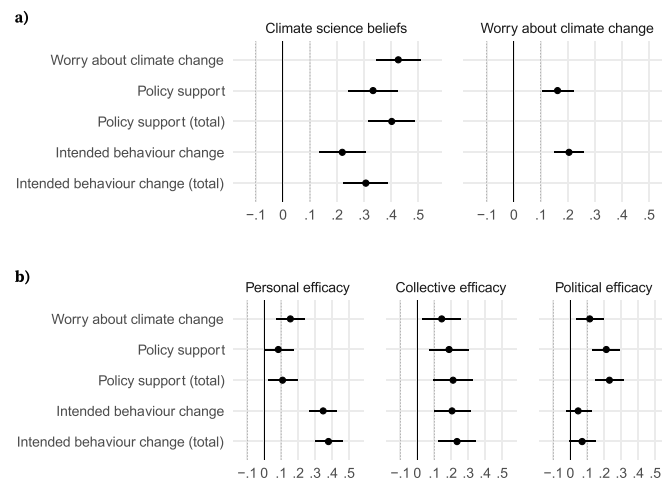


Fig. 7. Regressions from efficacy beliefs, climate science beliefs and worry about climate change to worry and outcome variables.

scientific agreement about climate change with the help of consensus messages may not lead to the desired goals of boosting policy support and intended behaviour change, despite it being a central “gateway belief” (van der Linden, Leiserowitz, et al., 2019). Targeting perceived scientific agreement using consensus messages may have had its time in the past, when public doubt about climate science was more widespread, or might find its use to repel future misinformation campaigns, in case they manage to sow doubt about the scientific consensus on human-made climate change. Similarly, as new areas of scientific consensus arise that might still be subject to public doubt (e.g. about the urgency of action), consensus messaging strategies may prove useful.

Strengthening public knowledge about climate science might also help achieve two goals in the current political and communication context. First, it could maintain the high levels of personal belief in climate science, for example if used in combination with inoculation strategies (Maertens, Anseel, & van der Linden, 2020). Second, targeting audiences susceptible to consensus messages might be fruitful (such as the ‘moderate right’) and using ‘ingroup messengers’ (Fielding et al., 2019) could, in some cases, assist in doing so. Yet, given that German media frequently report on different aspects of climate change, we believe that further research is needed on how to reach groups and individuals that have settled in their opposition to climate science and policy, even in light of overwhelming scientific, political, and public majorities that think otherwise.

The main communicative challenge in high-consensus countries seems to be finding ways to directly boost other predictors of policy support and intended behaviour change. To achieve this, the emphasis could lie on political initiatives and communication that supports perceptions of political efficacy while reinforcing individual climate science beliefs. Studies on the predictors of political climate change efficacy beliefs are rare, but Hart and Feldman (2014) note an absence of efficacy-oriented messages in US news, a pattern that has not changed in recent years (Tschötschel et al., 2020). Current communication efforts and academic research often emphasise the many ways in which individuals can act, for example by changing their transportation and consumption behaviour. Considering our study’s results, such efforts may be well-suited for promoting individual behaviour change by boosting personal efficacy beliefs but may have little effect on whether individuals support public policies on climate change.

Overall, policy interventions are potent levers to accelerate emissions reductions (Quéré et al., 2019) by influencing many of the conditions that shape individual behaviour and by triggering changes beyond the scope of individual action. Reporting on how policy can effectively combat climate change — a form of “solutions journalism” (McIntyre, 2019) using explicit ‘efficacy frames’ (Feldman & Hart, 2015) could prove effective in this regard, and prominent examples

show how the approach can be applied in a radio and podcasting format (BBC, n.d.; Gimlet Media, n.d.). However, specific evidence about the effects of climate change solutions journalism is lacking. Further studies on the drivers of political and collective climate change efficacy beliefs could prove crucial for promoting the public acceptance of policies and initiatives needed to achieve ambitious emissions reductions.

#### 4.1. Scope & limitations

We find it important to offer two notes about the scope and limitations of this study. First, we urge readers not to interpret our work as a clear-cut replication test of the original gateway belief model (van der Linden et al., 2015, 2019). Our analytical approach focused on post-treatment measures, in contrast to the originally used pre-post treatment difference measures (van der Linden, Leiserowitz, et al., 2019). In addition, introducing the survey as a study of attitudes to climate change and media use may have cued respondents into existing attitudes, and some respondents may not have read the treatment text as carefully as in the original research, further dampening its effects. Still, we believe in having offered strong evidence that the (admittedly simple) consensus messages used here have little to no substantial effects in the German context,<sup>4</sup> where climate protection is a politically salient topic.

Second, we believe to have added to the body of evidence that efficacy beliefs play an essential role in understanding the drivers of intended behaviour change and policy support. However, investigating how perceived scientific agreement, climate science beliefs and efficacy beliefs are causally related is beyond the scope of this study and requires further research.

Finally, our study was conducted in one country alone, and extrapolation to other cultural and political settings needs to be done with care. While many of the contextual factors are similar in other countries with the highest global per-capita emissions, even the fairly homogeneous group of European countries has considerable variation in terms of political systems, the media environment and current beliefs and attitudes towards climate science and climate policy. Moreover, outside this group, the public conversation about climate change occurs in even more different political and cultural settings. Different issues, such as the question of how to achieve (sustainable) economic development and

<sup>4</sup> As mentioned in section 2, for better comparability, and following our pre-registration, we re-analysed the post-exposure scores found in the data used by van der Linden, Maibach, et al. (2019), and used that information to build a post-exposure manifest variable model to provide a more direct replication test (Appendix D), which yields the same substantive conclusions.

which countries should bear the costs of the economic transition to a global zero-emissions economy, may play a more critical role in certain circumstances. In this case, entirely different communication challenges may be at play and strategies different from those discussed in this paper may be needed.

## 5. Concluding remarks

The results presented here show why extrapolating findings from one cultural context to another is difficult, even when they are reasonably similar on a surface level: while perceived scientific agreement is a key 'gateway', also in the German *high-consensus* context, the methods for its manipulation (consensus messages) are mostly ineffective. However, we caution communicators against abandoning the practice of consensus messaging altogether. While effects may be absent immediately after exposure, potential long-term effects, such as the 'inoculation' against future misinformation (Maertens et al., 2020), are just as important. In fact, it is possible that we are not finding effects due to the frequent exposure to this type of information. Nonetheless, we encourage a heightened focus by researchers and practitioners on how to boost efficacy beliefs directly. Our research confirms that personal efficacy is key to promoting pro-environmental behaviour, while political efficacy predicts policy support. To put it simply, mitigating climate change in a democratic society appears to need citizens convinced that their own and their elected officials' efforts are needed and effective. While consensus messages might do the trick in some low-consensus countries like the US, how this can best be achieved across the globe is an open question that deserves more scientific attention.

## Declaration of interest statement

The authors declare no conflicting interests.

## Funding

This research was supported by funding from the Amsterdam School of Communication Research, University of Amsterdam. Besides this, it did not receive funding from agencies or organisations in the public, commercial, or not-for-profit sectors.

## CRediT authorship contribution statement

**Robin Tschötschel:** Project administration, Funding acquisition, Conceptualization, Data curation, Methodology, Formal analysis, Visualization, Writing. **Andreas Schuck:** Supervision, Funding acquisition, Conceptualization, Methodology. **Alexandra Schwinges:** Methodology, Survey implementation, Resources. **Anke Wonneberger:** Supervision, Funding acquisition, Conceptualization, Methodology.

## Acknowledgements

The authors are grateful for many fruitful discussions with colleagues at the Amsterdam School of Communication Research, and the in-depth methodological advice by Sjifra de Leeuw and Wouter de Nooy. We thank the team at Dynata for offering excellent support during the fielding of the survey.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jenvp.2021.101655>.

## References

Ballew, M. T., Rosenthal, S. A., Goldberg, M. H., Gustafson, A., Kotcher, J. E., Maibach, E. W., et al. (2020). Beliefs about others' global warming beliefs: The role

- of party affiliation and opinion deviance. *Journal of Environmental Psychology*, 70, 101466. <https://doi.org/10.1016/j.jenvp.2020.101466>
- Bayes, R., Bolsen, T., & Druckman, J. N. (2020). A research agenda for climate change communication and public opinion: The role of scientific consensus messaging and beyond. *Environmental Communication*, 1–19. <https://doi.org/10.1080/17524032.2020.1805343>
- BBC. (n.d.). The Climate Question. Retrieved February 26, 2021, from [bbc.co.uk: https://www.bbc.co.uk/programmes/w13xtvb6](https://www.bbc.co.uk/programmes/w13xtvb6).
- Bradley, G. L., Babutsidze, Z., Chai, A., & Reser, J. P. (2020). The role of climate change risk perception, response efficacy, and psychological adaptation in pro-environmental behavior: A two nation study. *Journal of Environmental Psychology*, 68, 101410. <https://doi.org/10.1016/j.jenvp.2020.101410>
- Brüggemann, M., & Engesser, S. (2017). Beyond false balance: How interpretive journalism shapes media coverage of climate change. *Global Environmental Change*, 42, 58–67. <https://doi.org/10.1016/j.gloenvcha.2016.11.004>
- Chinn, & Hart. (2021). Climate Change Consensus Messages Cause Reactance. *Environmental Communication*. <https://doi.org/10.1080/17524032.2021.1910530>
- Chu, H., & Yang, J. Z. (2020). Risk or efficacy? How psychological distance influences climate change engagement. *Risk Analysis*, 40(4), 758–769. <https://doi.org/10.1111/risa.13446>
- Cook, J. (2019). *The consensus on consensus messaging*. Retrieved May 31, 2021 from <http://skepticalscience.com/consensus-consensus-messaging.html>
- Cook, J., & Lewandowsky, S. (2016). Rational irrationality: Modeling climate change belief polarization using bayesian networks. *Topics in Cognitive Science*, 8(1), 160–179. <https://doi.org/10.1111/tops.12186>
- Cook, J., Oreskes, N., Doran, P. T., Anderegg, W. R. L., Verheggen, B., Maibach, E. W., et al. (2016). Consensus on consensus: A synthesis of consensus estimates on human-caused global warming. *Environmental Research Letters*, 11(4), Article 048002. <https://doi.org/10.1088/1748-9326/11/4/048002>
- Dixon, G., Hmielowski, J., & Ma, Y. (2019). *More evidence of psychological reactance to consensus messaging: A response to van der Linden, Maibach, and Leiserowitz (2019)*. *Environmental Communication*. <https://doi.org/10.1080/17524032.2019.1671472>
- Erp, van, Mulder, J., & Oberski, D. L. (2018). Prior sensitivity analysis in default bayesian structural equation modeling. *Psychological Methods*, 23(2), 363–388. <https://doi.org/10.1037/met0000162>
- European Commission. (2019). *Special eurobarometer 490: Climate change*. Brussels: European Commission.
- ESS Round 9: European Social Survey Round 9 Data. (2018). *Data file edition 3.1. NSD - Norwegian Centre for Research Data, Norway – Data Archive and distributor of ESS data for ESS ERIC*. <https://doi.org/10.21338/NSD-ESS9-2018>
- Feldman, L., & Hart, P. S. (2015). Using political efficacy messages to increase climate activism. *Science Communication*, 38(1), 99. <https://doi.org/10.1177/1075547015617941>
- Feldman, L., Myers, T. A., Hmielowski, J. D., & Leiserowitz, A. (2014). The mutual reinforcement of media selectivity and effects: Testing the reinforcing spirals framework in the context of global warming. *Journal of Communication*, 64(4), 590–611. <https://doi.org/10.1111/jcom.12108>
- Fielding, K. S., Hornsey, M. J., Thai, H. A., & Toh, L. L. (2019). Using ingroup messengers and ingroup values to promote climate change policy. *Climatic Change*, 1–19. <https://doi.org/10.1007/s10584-019-02561-z>
- Fletcher, N., Newman, R., Kalogeropoulos, A., Nielsen, R. K., & Fletcher, R. (2019). *Reuters institute digital news report 2019*. Reuters Institute for the Study of Journalism.
- Garnier-Villarre, M., & Jorgensen, T. D. (2019). Adapting fit indices for bayesian structural equation modeling: Comparison to maximum likelihood. *Psychological Methods*, 25(1), 46–70. <https://doi.org/10.1037/met0000224>
- Gimlet Media (n.d.). How to Save a Planet. Retrieved February 26, 2021, from [gimletmedia.com: https://gimletmedia.com/shows/howtosaveplanet](https://gimletmedia.com/shows/howtosaveplanet).
- Goldberg, M. H., Gustafson, A., Ballew, M. T., Rosenthal, S. A., & Leiserowitz, A. (2019). A social identity approach to engaging christians in the issue of climate change. *Science Communication*, 41(4), 442–463. <https://doi.org/10.1177/1075547019860847>
- Gustafson, A., Rosenthal, S. A., Ballew, M. T., Goldberg, M. H., Bergquist, P., Kotcher, J. E., et al. (2019). The development of partisan polarisation over the Green New Deal. *Nature Climate Change*, 9(12), 940–944. <https://doi.org/10.1038/s41558-019-0621-7>
- Hake, J.-F., Fischer, W., Venghaus, S., & Weckenbrock, C. (2015). The German Energiewende - history and status quo. *Energy*, 92(3), 532–546. <https://doi.org/10.1016/j.energy.2015.04.027>
- Hart, P. S., & Feldman, L. (2014). Threat without efficacy? Climate change on U.S. Network news. *Science Communication*, 36(3), 325–351. <https://doi.org/10.1177/1075547013520239>
- Hart, P. S., & Feldman, L. (2016). The influence of climate change efficacy messages and efficacy beliefs on intended political participation. *PLoS One*, 11(8), Article e0157658. <https://doi.org/10.1371/journal.pone.0157658>
- Hmielowski, J. D., Hutchens, M. J., & Beam, M. A. (2020). Asymmetry of partisan media effects?: Examining the reinforcing process of conservative and liberal media with political beliefs. *Political Communication*, 1–17. <https://doi.org/10.1080/10584609.2020.1763525>
- Hornsey, M. J., Fielding, K. S., McStay, R., Reser, J. P., Bradley, G. L., & Greenaway, K. H. (2015). Evidence for motivated control: Understanding the paradoxical link between threat and efficacy beliefs about climate change. *Journal of Environmental Psychology*, 42, 57–65. <https://doi.org/10.1016/j.jenvp.2015.02.003>
- Hurst, K., & Stern, M. J. (2020). Messaging for environmental action: The role of moral framing and message source. *Journal of Environmental Psychology*, 68, 1013942. <https://doi.org/10.1016/j.jenvp.2020.101394>

- Institut für Demoskopie Allensbach. (2020). *Sonntagsfrage*. ifd-allensbach.de. Retrieved January 18, 2021, from <https://www.ifd-allensbach.de/studien-und-berichte/sonntagsfrage/gesamt.html>.
- IPCC. (2018). *Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty*. In Press.
- Kobayashi, K. (2018). The impact of perceived scientific and social consensus on scientific beliefs. *Science Communication, 40*(1), 63–88. <https://doi.org/10.1177/1075547017748948>
- Kousser, T., & Tranter, B. (2018). The influence of political leaders on climate change attitudes. *Global Environmental Change, 50*, 100–109. <https://doi.org/10.1016/j.gloenvcha.2018.03.005>
- Kruschke, J. K. (2018). Rejecting or accepting parameter values in bayesian estimation. *Advances in Methods and Practices in Psychological Science, 1*(2), 270–280. <https://doi.org/10.1177/2515245918771304>
- Kruschke, J. K., & Liddell, T. M. (2018). The Bayesian New Statistics: Hypothesis testing, estimation, meta-analysis, and power analysis from a Bayesian perspective. *Psychonomic Bulletin & Review, 25*(1), 178–206. <https://doi.org/10.3758/s13423-016-1221-4>
- Leiserowitz, A., Maibach, E., Rosenthal, S. A., Kotcher, J., Bergquist, P., Ballew, M. T., et al. (2020a). *Climate change in the American mind: April 2020*. New Haven, CT: Yale Program on Climate Change Communication. <https://doi.org/10.31234/osf.io/8439q>
- Leiserowitz, A., Maibach, E., Rosenthal, S., Kotcher, J., Carman, J., Wang, X., & Marlon, J. (2020b). *Politics & global warming, december 2020*. New Haven, CT: Yale Program on Climate Change Communication.
- Lewandowsky, S., Cook, J., Fay, N., & Gignac, G. E. (2019). Science by social media: Attitudes towards climate change are mediated by perceived social consensus. *Memory & Cognition, 47*(8), 1445–1456. <https://doi.org/10.3758/s13421-019-00948-y>
- van der Linden, S. L. (2021). The gateway belief model (GBM): A review and research agenda for communicating the scientific consensus on climate change. *Current Opinion in Psychology, 42*, 7–12. <https://doi.org/10.1016/j.copsyc.2021.01.005>
- van der Linden, S. L., Leiserowitz, A. A., Feinberg, G. D., & Maibach, E. W. (2015). The scientific consensus on climate change as a gateway belief: Experimental evidence. *e0118489 PLoS One, 10*(2), 8. <https://doi.org/10.1371/journal.pone.0118489>
- van der Linden, S. L., Leiserowitz, A., & Maibach, E. (2019). The gateway belief model: A large-scale replication. *Journal of Environmental Psychology, 62*, 1–47. <https://doi.org/10.1016/j.jenvp.2019.01.009>
- Ma, Y., Dixon, G., & Hmielowski, J. D. (2018). Psychological reactance from reading basic facts on climate change: The role of prior views and political identification. *Environmental Communication, 13*(1), 71–86. <https://doi.org/10.1080/17524032.2018.1548369>
- Maertens, R., Anseel, F., & van der Linden, S. (2020). Combatting climate change misinformation: Evidence for longevity of inoculation and consensus messaging effects. *Journal of Environmental Psychology, 70*, 101455. <https://doi.org/10.1016/j.jenvp.2020.101455>
- McIntyre, K. (2019). Solutions journalism. *Journalism Practice, 13*(1), 1–19. <https://doi.org/10.1080/17512786.2017.1409647>
- Mead, E., Roser-Renouf, C., Rimal, R. N., Flora, J. A., Maibach, E. W., & Leiserowitz, A. (2012). Information seeking about global climate change among adolescents: The role of risk perceptions, efficacy beliefs, and parental influences. *Atlantic Journal of Communication, 20*(1), 31–52. <https://doi.org/10.1080/15456870.2012.637027>
- Merkle, E. C., & Rosseel, Y. (2018). blavaan : Bayesian structural equation models via parameter expansion. *Journal of Statistical Software, 85*(4). <https://doi.org/10.18637/jss.v085.i04>
- Milfont, T. L. (2012). The interplay between knowledge, perceived efficacy, and concern about global warming and climate change: A one-year longitudinal study. *Risk Analysis: An Official Publication of the Society for Risk Analysis, 32*(6), 1003–1020. <https://doi.org/10.1111/j.1539-6924.2012.01800.x>
- Painter, J., & Ashe, T. (2012). Cross-national comparison of the presence of climate scepticism in the print media in six countries, 2007–10. *Environmental Research Letters, 9*(5). <https://doi.org/10.1088/1748-9326/9/5/054005>
- Poortinga, W., Fisher, S., Böhm, G., Steg, L., Whitmarsh, L., & Ogunbode, C. (2018). *European Attitudes to climate Change and energy (ESS topline results series issue No. 9)*. London: European Social Survey ERIC.
- Quére, C. L., Korsbakken, J. I., Wilson, C., Tosun, J., Andrew, R., Andres, R. J., et al. (2019). Drivers of declining CO2 emissions in 18 developed economies. *Nature Climate Change, 9*(3), 213–217. <https://doi.org/10.1038/s41558-019-0419-7>
- Quitrow, L., Canzler, W., Grundmann, P., Leibnath, M., Moss, T., & Rave, T. (2016). The German energiewende – what’s happening? Introducing the special issue. *Utilities Policy, 41*, 163–171. <https://doi.org/10.1016/j.jup.2016.03.002>
- Roelfsema, M., Soest, H. L. van, Harmsen, M., Vuuren, D. P. van, Bertram, C., Elzen, M. den, et al. (2020). Taking stock of national climate policies to evaluate implementation of the Paris Agreement. *Nature Communications, 11*(1), 2096. <https://doi.org/10.1038/s41467-020-15414-6>
- Schönbrodt, F. D., & Wagenmakers, E.-J. (2018). Bayes factor design analysis: Planning for compelling evidence. *Psychonomic Bulletin & Review, 25*(1), 128–142. <https://doi.org/10.3758/s13423-017-1230-y>
- van de Schoot, R., Veen, D., Smeets, L., Winter, S. D., & Depaoli, S. (2020). A tutorial on using the WAMBS checklist to avoid the misuse of Bayesian statistics. In R. van de Schoot, & M. Miočević (Eds.), *Small sample size solutions* (pp. 30–49). Oxon, UK: Routledge.
- Statistisches Bundesamt. (2020a). Bevölkerungsstand. Retrieved January 18, 2021, from undefined website: <https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Bevoelkerungsstand/Tabellen/zensus-geschlecht-staatsangehoerigkeit-2020.html>.
- Statistisches Bundesamt. (2020b). Durchschnittsalter nach Geschlecht und Staatsangehörigkeit 2011 bis 2019. Retrieved January 18, 2021, from [destatis.de: https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Bevoelkerungsstand/Tabellen/durchschnittsalter-zensus-jahre.html](https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bevoelkerung/Bevoelkerungsstand/Tabellen/durchschnittsalter-zensus-jahre.html).
- Stroud, N. J. (2010). Polarization and partisan selective exposure. *Journal of Communication, 60*(3), 556–576. <https://doi.org/10.1111/j.1460-2466.2010.01497.x>
- Tschötschel, R., Schuck, A., & Wonneberger, A. (2020). Patterns of controversy and consensus in German, Canadian, and US online news on climate change. *Global Environmental Change, 60*, 101957. <https://doi.org/10.1016/j.gloenvcha.2019.101957>
- van der Linden, S. L., Maibach, E., & Leiserowitz, A. A. (2019). *Exposure to scientific consensus does not cause psychological reactance* (Vols. 1–8). Environmental Communication.
- Verplanken, B., Marks, E., & Dobromir, A. I. (2020). On the nature of eco-anxiety: How constructive or unconstructive is habitual worry about global warming? *Journal of Environmental Psychology, 72*, 101528. <https://doi.org/10.1016/j.jenvp.2020.101528>
- Verschuur, M., Albers, C., Poortinga, W., Böhm, G., & Steg, L. (2020). Exploring relationships between climate change beliefs and energy preferences: A network analysis of the European social survey. *Journal of Environmental Psychology, 70*, 101435. <https://doi.org/10.1016/j.jenvp.2020.101435>
- Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. *Communication Monographs, 59*(4), 329–349. <https://doi.org/10.1080/03637759209376276>
- Yang, Z. J., Rickard, L. N., Harrison, T. M., & Seo, M. (2014). Applying the risk information seeking and processing model to examine support for climate change mitigation policy. *Science Communication, 36*(3), 296–324. <https://doi.org/10.1177/1075547014525350>