Climate change threats increase modern racism as a function of social dominance
orientation and ingroup identification

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CLIMATE CHANGE AND GROUP-BASED CONTROL & DOMINANCE

Highlights

- Experimental climate change threat-cues invoke increased intergroup threat perceptions and modern racism.
- Experimental intergroup threat-cues invoke increased climate change threat perceptions and modern racism.
- SDO moderates the relationship between experimental threat-cues (both climate change and intergroup threats) and modern racism, but not ingroup identification.
- Ingroup identification moderates the relationship between experimental climate change threat-cues and increased climate change threat perceptions, but not SDO.
- SDO predicts decreased climate change threats and lower support for pro-environmental collective action *ceteris paribus*.

Abstract

Processing information on the negative consequences of climate change can have unrelated side-effects such as increased outgroup derogation. Previous research suggests differing theoretical explanations for these “generalization” effects such as buffering existential anxiety. Across two pre-registered experiments ($N = 1031$; USA & UK), we examine whether ingroup identification and social dominance orientation (SDO) moderate the relationship between experimentally induced collective threats and subjective threat perceptions (i.e., climate change and intergroup threat), modern racism, and pro-environmental collective action support. In Study 1, SDO and ingroup identification were measured 2 years prior to our experiment as *antecedents* of threat perceptions. Our results suggest that informing individuals about negative consequences of climate change (e.g., wildfires, floods, resource scarcity, health etc.), leads to higher intergroup threat perceptions and modern racism. These generalization effects, in turn, are moderated by SDO but not by ingroup identification. In Study 2, we successfully replicate our findings, measuring SDO and ingroup identification directly after the threat manipulation. Moreover, we use a behavioral measure of pro-environmental collective action to assess more direct stimuli-responses. In Study 2, again, we show that SDO moderates the generalization effects. In contrast, ingroup identification showed only marginally significant moderation of the generalization effect and did not increase itself in response to experimental threat-cues. Notably, we also find that intergroup threat-cues generalize onto higher climate change threat perceptions. No effects on behavioral collective action support were found.

Keywords: climate-change; immigration; ingroup identification; SDO; modern-racism

Climate change threats increase modern racism as a function of social dominance orientation and ingroup identification

Climate change risks are one of the greatest threats facing the world today (IPCC, 2014, WEF, 2020). Consequently, communicating climate change risks often entails invoking a sense of threat to facilitate climate change mitigation and adaptation efforts (e.g., Brosch, 2021; van der Linden, Maibach, & Leiserowitz, 2015). Indeed, previous studies show that a sense of feeling threatened by climate change is associated with increased pro-environmental policy support (e.g., Leiserowitz, 2005; Uenal, Sidanius, & van der Linden, 2021). However, somewhat counterintuitively, previous research also shows that processing information on the negative consequences of climate change can have unintended side-effects such as increased outgroup derogation (e.g., Fritzsche, Cohrs, Kessler, & Bauer, 2012; Uhl, Jonas, & Klackl, 2016). Several differing theoretical explanations for these counterintuitive, generalization effects (i.e., collective threats invoking unrelated outcomes such as outgroup derogation) have been proposed within the broader threat and defense literature, such as symbolic defensive behaviors (i.e., buffering existential anxiety; Uhl, Klackl, Hansen, & Jonas, 2018), or restoring a sense of group-based control, meaning, or belonging (e.g., Fritzsche, Jonas, & Kessler, 2011; for an overview see: Jonas et al., 2014).

Climate change threats, however, are not perceived as threatening to the same extent by all members of a society (e.g., van der Linden, 2015). Similarly, climate change threats do not invoke unrelated reactions (e.g., outgroup derogation) unequivocally for all people (Uenal, Sidanius, van der Linden, 2021; Uhl et al., 2018). Therefore, it is important to understand the specific psychological mechanisms which

might explain varying levels of threat appraisals *and* differing types of threat reactions. In this vein, previous research has shown that appraisals of—and reactions to—threat cues are crucially shaped by individual differences in ideological orientations and characteristics related to one's group membership, besides other factors such as personality (e.g., Riek, Mania, & Gaertner, 2006; Stephan & Renfro, 2002; Uenal et al., 2021). Here, we propose that ingroup identification (Tajfel & Turner, 1986; Turner & Reynolds, 2003) and social dominance orientation (SDO; Sidanius & Pratto, 1999) should influence how individuals construe *and* react to differing types of external threat cues. More specifically, we argue that individual differences in ingroup identification and SDO should determine whether experimentally induced climate change threat-cues elicit higher climate change threat perceptions and pro-environmental behaviors and/or *generalize* onto increased intergroup threat perceptions outgroup derogation. We posit that climate change threat-cues should elicit higher intergroup threat perceptions and outgroup derogation (i.e., generalize) for individuals relatively high in ingroup identification and SDO. Against this background, the primary goal of this research is to test the moderating role of SDO (Pratto et al., 1994) and ingroup identification (using the national collective self-esteem scale; Luhtanen & Crocker, 1992) on the impact of experimentally manipulated external threat cues (climate change and intergroup threats) on three outcome variables: subjective threat perceptions (i.e., climate change and intergroup threat), modern racism (McConahay, 1986), and pro-environmental collective action support.

Despite a plethora of research on the relationship between SDO and ingroup identification on the one hand and threat perceptions and intergroup/environmental

outcomes on the other (Jonas et al., 2014; Riek et al., 2006, Uenal et al., 2021), prior research has four caveats that we want to address in this study. Firstly, both ingroup identification and SDO have previously been measured immediately prior to assessing perceived threat (only intergroup) and downstream consequences thereof, making group-based social (in)equality and group identity salient, which in turn might alter individual's perception of threats (Fischer, Haslam, & Smith, 2010; Kteily, Sidanius, & Levin, 2011). In contrast, here, both SDO and ingroup identification were assessed in an unrelated study, 2 years before the present study (Study 1). This approach allowed us to ascertain whether individuals SDO and ingroup identification levels shape threat appraisal and threat reactions without making these factors salient, that is, independently of external threat cues. Therefore, we expand previous research by analyzing both SDO and ingroup identification as *antecedents* of threat perceptions and reactions. Moreover, to the best of our knowledge, this is the first study to analyze SDO and ingroup identification with experimentally manipulated climate change and intergroup threat-cues concurrently. Secondly, previous research thus far has only analyzed whether climate change threat cues' impact intergroup perceptions and attitudes (e.g., outgroup derogation) but has not analyzed pathways leading from intergroup threat to climate change threat perceptions. Based on the threat and defense literature, it is conceivable that intergroup threat-cues can impact climate change threat perceptions, as individuals might feel a sense of loss of control, uncertainty, or anxiety when faced with intergroup threats and in turn, activate defensive coping strategies. Here, for the first time, we aim to test whether this generalization occurs in both directions (climate change threat $\Leftrightarrow$ intergroup threat) and whether SDO and ingroup

identification moderate these effects in both directions. Thirdly, prior research has predominantly used correlational methods. In studies which used an experimental design on the other hand, perceived threat is either not assessed or operationalized only as a manipulation check (Bilali, 2015). Treating threat perceptions as a manipulation check however impedes the possibility to distinguish between the impact of experimentally induced external threat-cues and subjective threat perceptions, as well as limiting our ability to assess the role of moderating factors that determine whether external threat-cues do indeed translate into subjective threat perceptions and downstream consequences thereof. To the best of our knowledge, this study represents the first attempt to assess the relationship between SDO/ingroup identification and perceived (climate change and intergroup) threats while simultaneously manipulating external threats. Fourthly, and lastly, we propose to analyze whether threat-cues and our proposed moderators have an impact on actual behaviors. Prior research has mostly used non-behavioral outcome variables (cf. Uenal et al., 2021). Here, we extend previous research by including a more behavioral measure (i.e., signing pro-environmental online petitions).

Threat and Defense Research

Why does processing information containing threat-cues (e.g., climate change, economic crises) trigger reactions like ethnocentrism¹ which do not directly pertain to or necessarily follow from these specific threat-cues (i.e., generalization effects)? Several

¹ The threat and defense literature utilizes the term *ethnocentrism* as an umbrella concept to refer to both ingroup bias (e.g., ingroup favoritism, ingroup identification, ingroup norm compliance) as well as to outgroup derogation (i.e., prejudice; see for example, Fritzsche, Jonas, & Kessler, 2011). This is a somewhat problematic conflation of concepts which have been shown to be psychologically distinct, albeit entangled processes (Brewer, 1999; Levin & Sidanius, 1999). Here, we analyze ingroup identification and outgroup threat perceptions and outgroup derogation as distinct phenomena.

theoretical frameworks have been proposed as explanations for these generalization effects within the broader threat and defense literature (for an overview see, Jonas et al., 2014). These theories include terror management theory (Greenberg, Pyszczynski, & Solomon, 1986; Pyszczynski, Solomon, & Greenberg, 2015), theories on restoring a sense of personal control, certainty, belonging, or meaning (e.g., Fritzsche, Jonas, & Kessler, 2011; Proulx & Inzlicht, 2012), and coalitional psychology (e.g., Navarrete, Kurzban, Fessler, & Kirkpatrick, 2004) amongst others. Despite wide ranging conceptual differences, these theories converge on a central premise: threats² can trigger aversive psychological reactions (i.e., experiences of discrepancy) which in turn can activate various *defensive coping* mechanisms to alleviate feelings of anxiety, uncertainty, loss of control, meaning, or belonging (Jonas et al., 2014, c.f. Navarrete et al., 2004).

For example, one line of studies within the threat and defense literature (e.g., Fritzsche, Jonas, & Kessler, 2011) posit that collective threats (e.g., terrorism, unemployment, climate change) can trigger aversive feelings such as loss of personal control. A sense of loss of control can be experienced as an aversive state as humans generally strive for a sense of control (Pittman & Zeigler, 2007; Skinner, 1996; White, 1959). Hence, humans have a general motivation to maintain and—in some cases—restore a general sense of control by means of coping mechanisms (Rothbaum, Weisz, & Snyder, 1982; Skinner, 2007; Tajfel & Turner, 1986). One potential psychological mechanism for alleviating feelings of control-loss is through (re-)affirmation of one's social group membership and shared group identity with a relevant social category. In

² Following Fritzsche, Jonas, and Kessler (2011), we define threat broadly as a “person's perception or feeling that something aversive is going to happen”. (Fritzsche, Jonas, & Kessler, 2011, p. 103).

other words, when faced with a threat to one's sense of control, shifting the perspective from the personal identity ("*I have no control*") to a relevant social identity ("*we do have control*") can provide a compensatory control mechanism counteracting feelings of discrepancy via empowerment through group-membership (e.g., Fritzsche, Jonas, & Fankhänel, 2008; Fritzsche, Jonas, & Kessler, 2011).

Ingroup identification, threats, intergroup bias, and pro-environmental action

Thus, one prominent defensive coping mechanism shared by some of the theoretical frameworks within the broader threat and defense literature pertains to group identity processes (Fritzsche et al., 2011; Jonas et al., 2014). More specifically, characteristics related to one's group membership (e.g., ingroup identification) are proposed as potential moderating factor which determine the extent of perceived threat, as well as shaping strategies to cope with them (e.g., Fritzsche et al., 2008; Fritzsche et al., 2013). Based on the literature on the relationship between ingroup identification, threat appraisal, and various downstream consequences of threat, two alternate predictions can be derived about the role of ingroup identification based on either social identity theory (Tajfel & Turner, 1986) or self-categorization theory (Turner & Reynolds, 2001).

Firstly, social identity theory (Tajfel & Turner, 1986) suggests that individuals highly identified with their ingroup are more sensitive to threat cues signaling potential harm to the ingroup. In turn, individuals highly identified with their ingroup might be more likely to pick up on threat-cues, be affected by them, and, in turn, display reactions more consistent with the notion of alleviating feelings of experienced discrepancy (Bizman & Yinon, 2001; Fischer, Haslam, & Smith, 2010). In line with this reasoning,

previous research has shown that ingroup identification interacts in this manner with *intergroup* threat to predict a variety of intergroup outcomes such as negative out-group attitudes (for a meta-analysis see: Riek et al., 2006). In the context of climate change threats, it is also conceivable that individuals might personally feel having little to no control as no single individual has significant efficacy let alone control over climate change processes. Moreover, climate change threatens the social, environmental, and economic welfare of entire nations and is frequently addressed in terms of a collective-national threat (e.g., van der Linden et al., 2015). Thus, information on climate change is also likely to be perceived as threat to the national ingroup and as such as a threat to one's social identity. Hence, in line with the threat and defense literature, one can hypothesize that individuals might react with increased identification with and adherence to one's ingroup and/or engage in increased outgroup derogation. Indeed, supporting this line of reasoning, previous experiments have shown that priming individuals with climate change threat-cues leads to higher ingroup bias and outgroup derogation. For example, Uhl and colleagues have shown in a set of cross-cultural studies that priming individuals with climate change threat-cues (vs. non-threatening information) increased derogation of norm-violating groups, controlling for biospheric values and environmental self-identity (Uhl et al., 2016; Uhl et al., 2018). Similarly, Fritzsche and colleagues (2012) have shown that experimentally priming participants with climate-change threat-cues (i.e., health risks, droughts, economic costs) invoked increased outgroup derogation (e.g., terrorists, criminals, drug addicts, gays, feminists). This effect in turn was moderated by increased right-wing authoritarian reactions, a concept frequently found to be associated with higher levels of ingroup identification and SDO (Duckitt & Sibley,

2017). These findings are thus aligned with a social identity perspective, such that external cues of threat produce higher perceived threat—both intergroup and climate change threats—and higher outgroup derogation/pro-environmental action among individuals highly identified compared to low identifiers.

Secondly, in contrast to social identity theory, self-categorization theory (Turner & Reynolds, 2001) posits that individuals frequently perceive the social world through a lens of their social self (vs. personal self). In line with this theory, several studies have shown that the strength of identification with one's ingroup is an *antecedent* of *intergroup* threat perceptions (e.g., Riek et al., 2006; Stephan & Stephan, 2002). Consistent with this idea, a set of studies (for a more recent overview see: Xiao, Coppin, & Van Bavel, 2016) has found ingroup identification to be an *antecedent* of intergroup outcomes including intergroup threat perceptions. Consequently, ingroup identification should also predict higher perceived threat (intergroup and climate change) and higher outgroup derogation and pro-environmental behaviors *independent* of external cues of threat: that is, individuals highly identified with their ingroup (vs. low identifiers) might perceive higher threat, which in turn might lead to higher outgroup derogation and pro-environmental behaviors independent of the level of external threat.

Advancing previous research, in the present paper we propose to test a self-categorization perspective by analyzing the effects of collective climate change and intergroup threat-cues on outgroup derogation (i.e., modern racism, McConahay, 1986) as a function of ingroup identification directly for the first time. Citing both social identity theory and self-categorization theory, previous studies within the threat and defense literature have posited that threat-cues should translate into higher *ethnocentrism*

especially for individuals highly identified with their ingroup (e.g., Fritzsche et al., 2013). However, previous studies have not yet tested the role of ingroup identification as *antecedent* of these effects. In other words, previous research has assessed ingroup identification after experimentally priming threat-cues, but not beforehand, thus not strictly treating it as antecedent of threat. Following self-categorization theory, ingroup identification with an important social category should moderate the effect of climate change threat-cues on outgroup derogation such that this effect should be more pronounced for individuals who strongly identify with their ingroup. To test this proposition directly, we will use data on national ingroup identification which we collected in an unrelated, non-experimental study back in late 2018. This will allow us to test the proposed moderating role of ingroup identification without making ingroup identification salient during the experiment and thus, enabling us to treat it as an antecedent factor (for a similar approach see: Bilali, 2015).

Furthermore, following the threat and defense literature, collective threats are proposed to cause feelings of discrepancy on the individual-personal level and in turn, prompt a shift to the group-identity perspective which then can trigger negative outgroup reactions. However, previous research has not yet tested whether collective climate change threat-cues trigger higher subjective threat perceptions on the individual-personal and/or group levels. Here, we propose to address this caveat by assessing subjective threat perceptions (both climate change and intergroup related) on the individual-personal and collective-group levels. This approach will allow us to test whether collective climate change threat-cues lead to higher threat appraisals on the personal-individual or collective-group level, as a function of ingroup identification.

SDO, threats, intergroup bias, and pro-environmental action

An alternative explanation for the observed effects of collective threats (i.e., climate change) on outgroup derogation could be associated with people's personal ideological orientations. Indeed, Fritzsche and colleagues (2012) have shown that right-wing authoritarianism (i.e., authoritarian submission and aggression) moderates the relationship between experimental climate-change cues and derogation of outgroups.

Another highly relevant yet distinct psychological predisposition potentially moderating these generalization effects is Social Dominance Orientation (SDO, Pratto et al., 1994; Ho et al., 2015). SDO is an individual difference construct designed to assesses the degree to which individuals personally endorse or oppose community arrangements where some social groups dominate others (Sidanius & Pratto, 1999). SDO is theoretically and statistically distinct from RWA, ingroup identification, and personality (e.g., de Vries et al., 2021). Individuals high in SDO are characterized by a general motivation for group-based dominance in which high status groups control and dominate low-status groups. For example, it has been shown that one's level of SDO is highly contingent on one's personal position in a given hierarchy such that SDO only reflects self-interest when measured in dominant groups, while people from lower-ranking groups tend to score substantially lower on SDO (Kleppestø, Eftedal, & Thomsen, 2020).³ Notably, preferences for (or against) group-based hierarchy between groups—as measured by SDO—have been shown to be partially heritable in a large-sample twin-design study (Kleppestø et al., 2019). As such, SDO has been shown to be

³ To illuminate this point a bit further: The ideological asymmetry hypothesis (Levin, Sidanius, Rabinowitz, & Federico, 1998) posits that both group-status as well as group-affiliation can shape the relationship between SDO and outgroup biases.

an *antecedent* of intergroup threat perceptions such that individuals with higher SDO scores display increased intergroup threat perceptions (e.g., Uenal, 2016). In the same vein, SDO has been shown to be highly predictive of a multitude of socially relevant attitudes such as sexism, racism, and support for intergroup violence (Sidanius et al., 2017).

More recently, SDO has also been shown to negatively relate to attitudes toward the natural environment. More specifically, a growing body of results has shown that individuals scoring relatively high on SDO are more inclined to downplay climate change (e.g., Jylhä & Akrami, 2015; Milfont et al., 2018), are low on pro-environmental policy support, and perceive climate change as less of a threat in general (Uenal et al., 2021). Thus, individuals scoring relatively high on SDO might not perceive climate change as a threat *per se* even when primed with climate change threat-cues. On the other hand, climate change does pose a significant threat to the social and economic order of societies and the group-based hierarchies they are built on due to increased resource scarcity (e.g., Díaz et al., 2019; IPCC, 2014). As a result, climate change threat-cues might trigger anticipation of heightened intergroup competition and conflict. Previous research has shown that individuals high in SDO are especially attuned to information which signals increased competition for resources and privileges arising from disruptive social changes to the social hierarchy of status and power (e.g., Duckitt & Sibley, 2017). As such, individuals scoring relatively high in SDO might pick up on this aspect of climate change threat-cues and react with increased intergroup threat perceptions and outgroup derogation in response.

Despite a wealth of studies on the relationship between SDO and collective threats (i.e., intergroup threats and climate change; Uenal, 2016; Uenal et al., 2021), previous research in the threat and defense literature on climate change has not yet analyzed SDO as a moderating variable. In contrast to ingroup identification and right-wing authoritarianism, SDO is mainly concerned with explaining the ubiquitous nature of exploitation, social and ecological inequalities, and power relations between and within different social groups and species (de Vries et al., 2021; Uenal et al., 2021). Thus, it is uniquely situated to explain individual differences at the cross-section of intergroup and environmental issues as well as in the interplay between collective and individual level processes. Therefore, we advance previous research by testing SDO as a moderating variable, potentially explaining previously observed generalization effects.

Overview of Hypotheses and Studies

In sum, previous research has not yet analyzed SDO and ingroup identification as *antecedent* moderators of generalization effects. Moreover, previous research has not yet analyzed whether generalization effects occur in both directions (climate change threat $\Leftrightarrow$ intergroup threat) and has mostly focused on the individual-level of attitudinal collective threat responses. Furthermore, previous research has mostly used individual behavioral intentions as downstream consequence of threat-appraisals. Addressing these gaps in the literature, the goal of this paper is to advance previous research on the relationship between collective threats (i.e., climate change and intergroup threat), subjective threat appraisals (i.e., individual and group levels), and associated generalization effects in both directions by investigating two previously untested psychological mechanisms, i.e., social dominance orientations and ingroup identification

as moderators. Moreover, we advance previous research by assessing our proposed moderators prior to the experimental manipulation and thus testing them as antecedent factors (Study 1) as well as posterior factors (Study 2). Finally, we extend previous research by systematically analyzing the interplay between collective and individual phenomena and by analyzing more *behavioral* downstream consequences of threat-cues (Study 2).

We tested our hypotheses (see further below) in two pre-registered studies in two different national contexts (USA and UK; N = 1031). A detailed overview of our hypotheses is presented in the Supplementary Online Materials (see SOM, S-Hypotheses 1). Both studies were approved by the Department of Psychology ethics committees at Harvard University. In Study 1, we examined the impact of experimentally induced external cues of climate change threat and intergroup threat (vs. control) on both perceived climate change and intergroup threat perceptions and modern racism as a function of in-group identification and social dominance orientation in the USA. In Study 1, SDO and ingroup identification were measured two years prior to the current study, in an unrelated cross-sectional study. In Study 2, we aimed at replicating the results of Study 1 in a different national context (UK).⁴ Moreover, to assess whether the external threat manipulation has a direct effect on ingroup identification, in Study 2, we measured ingroup identification (and SDO) directly after the external threat manipulation. Lastly, for Study 2, we also employed a behavioral measure of support for collective action (i.e., climate change mitigation policy support) as the dependent variable. For each study, the required sample sizes were calculated via power analyses

⁴ We chose the UK as national context for our replication because it allowed us to test our hypothesis with minimal changes to the stimulus materials (i.e., language, cultural references).

individually to meet an 80% chance to observe a hypothesized effect. Detailed power analyses calculations for each statistical analysis are included in the SOM (S1). All pre-registered hypotheses, measures, manipulations (see SOM-Stimuli), quality checks, descriptive statistics, and data exclusions for each study are reported in the respective method sections, the pre-registrations, and in the SOM (S-Hypotheses 1 & 2, and Table S2).

Hypotheses

Based on our literature review, we posited the following hypotheses in our preregistration. Figure 1 depicts our hypotheses for Study 1.⁵

Figure 1. Illustration of the hypothesized effects of externally manipulated threat-cues (vs. no-threat control group) on subjective threat perceptions (climate change and

⁵ For ease of comprehension, we re-numbered our hypotheses from our original numbering in the pre-registrations. Moreover, we present additional hypotheses for Study 2 further below in Study 2.

intergroup threats) and modern racism, as moderated by social dominance orientation, and ingroup identification, controlling for political orientation (not displayed in Figure).

Dotted lines represent generalization effects.

Main Effects. In line with previous research, we hypothesize that climate change threat-cues (upper pathway in Fig.) will invoke increased climate change threat (H1a) as well as generalize onto higher intergroup threat perceptions (H1b) and higher modern racism (H1c). Similarly, for intergroup threat-cues (lower pathway in Fig.), we hypothesize increased subjective intergroup threat perceptions (H2a), increased modern racism (H2b). Importantly, we will also test whether intergroup threat-cues generalize onto climate change threat perceptions (H2c). Previous research thus far has only analyzed generalization effects from climate change or economic crisis onto intergroup attitudes (e.g., outgroup derogation) but not the other way around. However, it is also conceivable that intergroup threat-cues can generalize on climate change threat perceptions, as individuals might feel a sense of loss of control, meaning, or belonging when faced with intergroup threats and in turn, activate defensive coping mechanisms to alleviate said experiences of discrepancy. Here, for the first time, we aim to test whether generalization effects occur in both directions (climate change threat $\Leftrightarrow$ intergroup threat).

Moderator and Interaction Effects. Based on the discussed research pertaining to SDO, we hypothesize that SDO should moderate the effect of climate change threat-cues on climate change threat perceptions such that for individuals scoring higher on SDO, climate change threat perceptions should be buffered (H3a). This hypothesis is

based on previous results showing that individuals relatively high in SDO show substantially lower levels of climate change risk and threat perceptions (Uenal et al., 2021). Moreover, in line with previous research showing that individuals relatively high in SDO being highly attuned to information which signals increased competition for resources, status, and power (e.g., Duckitt & Sibley, 2017; Hudson, Sidanius, & Cikara, 2019; Sidanius et al., 2017), we posit that individuals scoring relatively high on SDO should react with increased intergroup threat perceptions (H3b) and outgroup derogation (H3c) when confronted with information on the negative consequences of climate change as well as when exposed to intergroup threat-cues (H3d-H3e).

Based on the literature review pertaining to ingroup identification we postulate the following hypotheses. Because individuals highly identified with their ingroup have been shown to be especially sensitive to threat-cues pertaining to their ingroup, we expect a moderation by ingroup identification such that the effects of climate change threat-cues on subjective climate change threat perceptions will be more pronounced for individual highly identified with their ingroup (H4a). Similarly, we expect to find ingroup identification to moderate the relationship between experimentally induced climate change threat-cues and intergroup threat perceptions (H4b) and outgroup derogation (H4c) such that the generalization effect will be more pronounced for high identifiers. Moreover, in line with previous research on ingroup identification and intergroup threats (e.g., Riek et al., 2006), for participants exposed to intergroup threat-cues, we also expect a moderation by ingroup identification in the same direction (H4d-H4e). Lastly, we will also test whether SDO and ingroup identification moderate the generalization effects bidirectionally (H3f and H4f).

Study 1

Methods

Participants. The present study was pre-registered (see: <https://aspredicted.org/blind.php?x=p3kx5d>).⁶ Following our power calculations (see SOM, S1), we recruited 400 participants in the USA using Prolific in October 2020. Participants received \$1.90 payment each (£6.45 per hour rate), as compensation for their time and effort. Participants were asked to answer an attention check question by choosing one specific answer option at the beginning of the survey. Participants who failed the quality check were excluded. In total 22 participants were removed due to failing the attention check (as pre-registered), resulting in a final sample size of 378. The sample consisted of 180 female participants (47.6 %) and the average age was 45.09 ($SD = 13.19$). Detailed descriptive statistics and power analyses are provided in the SOM (S1-S2).

Materials and procedure. We conducted an online experiment with external threat-cues as an independent variable with three levels (climate change threat, intergroup threat, and control). Perceived subjective climate change and intergroup threats and modern racism are the dependent variables. Social dominance orientation and ingroup identification served as moderators and were assessed in a previous study.

⁶ We deviate minimally from our preregistration in the following way. In the pre-registration we indicated that we would use intergroup threat perceptions measures adapted from Stephan & Renfro (2002) and Uenal (2016). These measures use seven-point Likert-scales with multiple items pertaining to intergroup threats. However, after the pre-registration was completed, we decided to measure subjective intergroup threat perceptions in the same way as we measure subjective climate change threat perceptions. The subjective climate change threat perceptions are scored on a 1-100 scale and pertain to threat perceptions on the personal, group, and global levels. As one of our aims was to analyze and compare climate change and intergroup threat perceptions across these levels, we chose to assess both threat types in the same way. Thus, we adapted our subjective climate change threat perceptions (Uenal, Sidanius, & van der Linden, 2020) for the intergroup domain.

We contacted participants from an unrelated previous study conducted in 2018, to participate in our current survey experiment (for a similar study design, see Bilali, 2015).⁷ Only participants who agreed to be contacted for future studies were re-invited and were told that they qualified for a new study on “current social issues”. In the previous non-experimental study, participants had filled out measures of SDO and ingroup identification. In this Study, we use the data on these scales as moderators. The reasoning behind this procedure was to avoid making SDO and ingroup identification salient and thus exclude them as immediate influencing variables (e.g., Fischer, Haslam, & Smith, 2010). First, participants were randomly assigned to read one of three newspaper articles in the three experimental conditions (climate change threat vs. intergroup threat vs. control; see SOM-Stimuli Study 1 for materials). In the control condition, participants read an article containing no threat-cues, entitled “‘Friends’ Is Turning 25. Here’s Why We Can’t Stop Watching it.” reporting on the success and popularity of the TV-Show “Friends”. In the climate change threat condition, participants read an article entitled “Climate change ‘major threat’ to US, new study warns” alerting readers on the negative consequences (“...severe, pervasive and irreversible...”) of climate change for the USA (e.g., wildfires, floods, resources scarcity, health etc.). In the intergroup threat condition, participants were provided an article entitled “The Islamic veil across the US” informing them about cultural and social issues related to Muslim immigration to the USA. The articles are all based on various existing news articles. However, to reduce biases due to political (dis)trust in specific newspaper

⁷ As determined via Power Analysis (see SOM, S1), we re-invited a total of 400 participants, randomly picked from a larger pool of participants from an unrelated Study conducted in 2018, to take part in the current Study.

outlets (i.e., Fox vs. CNN), we changed the outlet to be BBC across all groups. Previous research has shown that the BBC news-outlet is one of the more trusted news sources in the US across the political spectrum (PEW Research, 2014). Participants were informed about this deception at the end of the experiment.

After reading one of the three articles, participants were asked comprehension questions to assess their engagement with the articles (i.e., comprehension checks). Participants then responded to manipulation checks (i.e., agreement with the news article) and their news perceptions (e.g., alarming, disturbing). Next, participants responded to different emotions they might have experienced during the last week. This emotion assessment served (a) as a filler task and delay to mask the connection between experimental manipulations and the following questions on the climate change and intergroup threat perceptions and modern racism; and (b) allowed us to assess whether the threat and control manipulations influenced participants' emotions. In the final stage, participants responded to our main DVs (i.e., subjective threat perceptions and modern racism), provided demographic information, and were debriefed. To test potential generalization effects, we presented subjective threat perceptions unrelated to the manipulation first, such that, for example, participants in the climate change threat condition were first presented with intergroup threat perceptions and then climate change threat perceptions and vice versa.

Agreement with news report. To ascertain if the information conveyed in the news articles was similarly credible across conditions, one item measured the extent to which participants agreed with the report (i.e., agreement with news report; 1 = *strongly disagree*; 5 = *strongly agree*).

Comprehension checks. To assess whether participants paid attention to the news articles we asked two questions pertaining to the content of the articles (e.g., “According to the news report, are the impacts of climate change going to be very severe or not at all severe?”; 1 = *not at all severe*; 5 = *very severe*).

Manipulation check. To assess the degree to which the news article elicited a sense of alarm, participants responded to three items “Do you find the News Report alarming [*disturbing; troubling*]?” (1 = *not at all alarming* [*disturbing; troubling*]; 5 = *very much alarming* [*disturbing; troubling*]). If the threat manipulation is effective, then participants in the threat conditions should find the news report more alarming, troubling, and/or disturbing compared to the control condition ($\alpha = .89$).

Affect. To ascertain whether the news articles influenced participants’ emotions across conditions, we assessed emotions using the positive and negative affects scale (PANAS; Watson, Clark, & Tellegen, 1988). Participants rated 16 emotions indicating to what extent they experienced them in the last week on 7-point scales (1 = *Very slightly or not at all*; 7 = *Extremely*). The results of an Exploratory Factor Analysis (EFA) using maximum likelihood extraction method and Promax rotation with the measured items yielded four factors in total (see S3 in SOM), representing anger (e.g., hostile, upset; $\alpha = .93$), fear (e.g., scared, jittery, afraid; $\alpha = .94$), guilt (e.g., ashamed, guilty; $\alpha = .89$), and sadness (e.g., distressed, nervous, irritable; $\alpha = .89$). Following these results, we computed four constructs.

Instruments. All measures were scored on a seven-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) unless indicated otherwise. Importantly, the

SDO and ingroup identification measures were assessed in a previous, unrelated study, as described above.⁸

Social dominance orientation (SDO). Social dominance orientation was assessed in a previous study through use of the 16-item SDO₇ scale (Ho et al., 2015; e.g., “Some groups of people are simply inferior to other groups”; “Superior groups should dominate inferior groups”; “No one group should dominate in society” [reverse scored]; $\alpha = .95$).

Ingroup identification. Ingroup identification was measured in a previous study using five items (e.g., “I feel strongly connected to other Americans”; $\alpha = .94$) adapted from the collective self-esteem scale (Luhtanen & Crocker, 1992).

Climate change threat perceptions. Climate change threat perceptions were assessed with 3 items using adapted versions of previously used items (Uenal, Sidanius, & van der Linden, 2020) such that we assessed climate change threat perceptions pertaining to the individual personally, the USA, and the world (e.g., “Using the sliders below, please indicate how threatening you find climate change for... [you personally; the USA; the World]?”) on a scale ranging from 1 (*Not at all threatening*) to 100 (*Extremely threatening*). The results of an EFA with the measured items yielded one factor which explained 92.23% of the variance in total (see S3 in SOM), representing climate change threat perceptions across threat levels ($\alpha = .95$). Following these results, we computed one construct.

⁸ A *t* test for mean-level differences in participants SDO (T₁: $M = 2.53$, $SD = 1.37$; T₂: $M = 2.61$, $SD = 1.41$) and ingroup identification T₁: $M = 5.13$, $SD = 1.39$; T₂: $M = 5.04$, $SD = 1.32$) scores between 2018 and the current study showed no significant mean-level differences for SDO ($t(754) = 0.79$, $p = 0.429$) or ingroup identification ($t(754) = 0.91$, $p = 0.362$).

Intergroup threat perceptions. Similar to climate change threat perceptions, intergroup threat perceptions were assessed with 3 items (e.g., “Using the sliders below, please indicate how threatening you find immigration for... [you personally; the USA; the World]?”) on a scale ranging from 1 (*not at all threatening*) to 100 (*Extremely threatening*). The results of an EFA with the measured items yielded one factor which explained 89.52% of the variance in total (see S3 in SOM), representing intergroup threat perceptions across relational domains ($\alpha = .94$). Following these results, we computed one construct.

Modern racism. Contemporary racial prejudice was assessed by the Modern Racism scale (McConahay, 1986) with seven items (e.g., “Ethnic minorities are getting too demanding in their push for equal rights”; “It is easy to understand the anger of ethnic minority people in America.” [reverse scored]; $\alpha = .91$).

Demographic information and control variables. To account for potential confounding variables, we included the following questions: age, gender, highest education level attainment, household income, current employment status, ethnicity, and political orientation on seven-point scales ranging from 1 (very liberal) to 7 (very conservative).

Results

Table 1 shows the mean scores, standard deviations, and inter-correlations among all variables. All the measures showed significant inter-correlations in the expected direction. Correlations between variables in each condition can be found in the SOM (Table S4).

Table 1

Correlations Between Variables Across All Groups (Study 1)

Measures	<i>M</i>	<i>SD</i>	2.	3.	4.	5.	6.
1. Social dominance orientation	2.61	1.41	.17**	.53***	-.48***	.60***	.54***
2. Ingroup identification	5.04	1.32		.41***	-.08	.38***	.34***
3. Intergroup threat perceptions	30.91	30.72			-.17**	.85***	.51***
4. Climate change threat perceptions	66.27	30.10				-.30***	-.46***
5. Modern racism	3.18	1.61					.61***
6. Political orientation	3.78	1.83					—

Note. ** $p < .01$, *** $p < .001$

Main effects.⁹ Next, we ran an Analysis of Variance Analysis (ANOVA) to assess the effects of the threat manipulations. The results are summarized in Table 2 and suggest the manipulations were successful as indicated by significant differences for the majority of measures. Participants in both threat conditions found the news more alarming and showed more agreement with the news than participants in the control condition. Moreover, the results showed no differences in affective states across conditions and thus, the experimental manipulations did not influence participants' affect.

⁹ As a first step, prior to the following ANOVAs, we performed a multivariate analysis of variance (MANOVA) to help protect against inflating the Type 1 error rate in the follow-up ANOVAs and to test the hypothesis that there would be one or more mean differences between our threat manipulation conditions (control, climate change threat, intergroup threat) and our three dependent variables. As shown in Table 1, a meaningful pattern of correlations was observed amongst most of the dependent variables (between $-.48$ - $.60$), suggesting the appropriateness of a MANOVA. A statistically significant MANOVA effect was obtained, $F(18, 736) = 20.56$, $p < .001$; Pillais' Trace = $.67$, partial $\eta^2 = .33$. The multivariate effect size was estimated at $.667$, which implies that 33.4% of the variance in the canonically derived dependent variable was accounted for by the threat manipulations.

Table 2

Between-Group Differences Across Conditions (Study 1)

Measures	Control		Climate change		Intergroup threat		<i>F</i>	η_p^2
	condition		condition		condition			
	(<i>n</i> = 122)		(<i>n</i> = 127)		(<i>n</i> = 129)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
News perception	3.74 _{a,b,c}	0.83	4.24 _{a,b,c}	1.09	3.20 _{a,b,c}	1.28	29.40***	.136
Agreement news	1.73 _{d,e,f}	0.81	4.13 _{d,e,f}	0.96	3.43 _{d,e,f}	1.12	197.56***	.513
Perceived threat								
Climate change	59.76 _g	31.14	72.88 _g	28.36	65.91	29.59	6.08**	.031
Intergroup	19.30 _{h,i,j}	21.68	40.99 _{h,i,j}	34.25	31.96 _{h,i,j}	30.82	16.95***	.083
Affective States								
Anger	2.43	1.37	2.59	1.49	2.53	1.38	0.39	.002
Fear	2.79	1.61	2.65	1.53	2.71	1.51	0.28	.002
Guilt	3.45	1.47	3.53	1.49	3.48	1.42	0.10	.001
Sadness	3.32	1.57	3.48	1.54	3.44	1.55	0.37	.002
Modern Racism	2.75 _{k,l}	1.34	3.53 _k	1.76	3.23 _l	1.62	7.63***	.039

** $p < .01$, *** $p < .001$

Notes. The reference group is the control condition. Within rows, means with the same subscripts are significantly different with Bonferroni corrections. Their specific significance levels are as follows: ^{a-f} $p < .001$, ^g $p < .01$, ^h $p < .001$, ⁱ $p < .01$, ^j $p < .05$, ^k $p < .001$, ^l $p = .051$

In line with our hypotheses, post-hoc tests with Bonferroni correction indicated that climate change threat-cues elicited significantly higher climate change threat perceptions (H1a) and intergroup threat perceptions (H1b), as well as higher levels of modern racism (H1c) compared to the control condition (see Table 2). In accordance

with our hypothesis, intergroup threat-cues evoked significantly higher levels of intergroup threat perceptions (H2a) and modern racism (H2b) than the control group but showed no effect on climate change threat perceptions. The climate change threat and intergroup threat conditions also differed significantly from each other on the intergroup threat perceptions measure with climate change threat cues eliciting significantly higher intergroup threat perceptions compared to the intergroup threat condition.

Next, we ran an ANOVA to test for differences in threat appraisals on the individual, national-group, and global levels. As shown in Table 3, participants perceived both climate change and intergroup threats the lowest at the personal level followed by higher levels on the national-group level and the highest for on the global level.

Table 3

Between-Group Differences in Threat Perceptions Across Conditions (Study 1)

Measures	Control		Climate change		Intergroup threat			
	condition		condition		condition			
	(n = 122)		(n = 127)		(n = 129)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	η_p^2
Climate change threat								
perceptions								
Personal	50.25 _a	32.86	64.74 _a	31.76	57.26	33.51	6.10**	.032
USA	61.43 _b	31.16	74.27 _b	29.18	67.27	29.72	5.62**	.029
World	67.61 _c	32.15	79.63 _c	28.19	73.22	29.49	5.02**	.026
Intergroup threat								
perceptions								
Personal	11.06 _{d,e,f}	15.78	31.93 _{d,e,f}	33.91	22.41 _{d,e,f}	28.29	18.33***	.089
USA	22.97 _{g,h}	25.69	45.98 _g	37.49	36.77 _h	34.25	15.33***	.076
World	23.86 _{i,j}	28.08	45.08 _i	36.89	36.69 _j	34.95	12.56***	.063

****** $p < .01$, ******* $p < .001$

Notes. The reference group is the control condition. Within rows, means with the same subscripts are significantly different with Bonferroni corrections. Their specific significance levels are as follows: ^{a-c} $p < .01$, ^d $p < .001$, ^e $p < .01$, ^f $p < .05$. ^g $p < .001$, ^h $p < .01$, ⁱ $p < .001$, ^j $p < .01$.

Moderation by SDO and ingroup identification. To test our hypotheses on the moderation effects, we performed three regression analyses on our dependent variables using the PROCESS macro (Version 3.3) by Hayes (2018) for a multi-categorical moderation analysis (Model 2).¹⁰ The three experimental conditions represented by two dummy-coded variables for the climate change threat/intergroup threat (vs. control) conditions were entered as predictors along with SDO (centered) and ingroup identification (centered), and the respective two-way interactions. Political orientation was entered as covariate. The indicator-approach for the multi-categorical independent variable coded into two dummy variables (D1: 0 = Control, 1 = Climate change threat, 0 = Intergroup threat; D2: 0 = Control, 0 = Climate change threat, 1 = Intergroup threat) was used as well as bootstrapping with 5,000 random re-samples to estimate 95% confidence intervals for the interaction effects. Multicollinearity

¹⁰ Here, we present the results for the aggregated threat perception constructs. We also ran regression analyses using the threat items at different level of threat perception (e.g., personal, group, global levels). In sum, only SDO showed a significant interaction with the climate change threat condition in predicting higher intergroup threat perceptions across the personal, group, and global levels of threat perceptions. In contrast, ingroup identification showed no significant interaction with the climate change condition on any level of threat perception. Thus, analyzing the threat perceptions on different levels of threat appraisal showed no moderation of generalization effects by ingroup identification. We present detailed results on these analyses in the SOM (see S5 and Table S6 in the SOM).

diagnostics for each model showed a $VIF_{Max} = .125$ indicating no multicollinearity issues.

In line with our expectations, the climate change condition showed a significant positive effect on our three dependent variables (H1a-c). The intergroup threat condition showed significant positive effects on intergroup threat perceptions and modern racism (H2a-H2b) but only a marginally significant effect ($p = .052$) on climate change threat perceptions. Moreover, as posited (H3a), SDO had a significant effect in predicting lower climate change threat perceptions and higher intergroup threat and modern racism (H3b-H3c), controlling for the effects of ingroup identification and political orientation. In contrast, ingroup identification showed only significant effects on modern racism (H4c), but not on either threat perception (H4a & H4b).

In the first moderation (see Table 4), with intergroup threat perceptions as the dependent variable, the interaction between SDO and the climate change condition was significant (H3b). Simple slopes showed that, when participants read about the consequences of climate change on the USA, higher SDO predicted ($b = 5.50$, 95%CI [1.62, 9.38], $t(368) = 2.78$, $p = .006$) higher intergroup threat perceptions (see Fig. 4). Similarly, when participants read about intergroup threats, higher SDO also predicted ($b = 4.69$, 95%CI [0.01, 9.37], $t(368) = 1.97$, $p = .049$) higher intergroup threat perceptions (H3d). In the second moderation, with climate change threat perceptions as dependent variable, no significant interaction with either condition was found (H3a). In the third moderation, with modern racism as dependent variable, the interaction between SDO and the climate change condition was significant (H3c). Simple slopes showed that,

when participants read about climate change, higher SDO predicted higher modern racism ($b = 0.24$, 95%CI [0.05, 0.44], $t(368) = 2.43$, $p = .016$) (see Fig. 4).

Table 4

Regression Analyses Predicting Subjective Threat Perceptions and Modern Racism.

	Intergroup Threat				Climate Change Threat				Modern Racism			
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Climate change threat dummy	20.33	2.84	7.15	< .001	12.79	3.23	3.95	< .001	0.71	.15	4.81	< .001
Intergroup threat dummy	11.26	2.48	4.54	< .001	6.61	3.38	1.95	.052	0.39	.13	2.98	.003
SDO	4.25	1.50	2.82	.005	-7.28	1.69	-4.29	< .001	0.28	.08	3.41	< .001
SDO x Climate change threat	5.50	1.97	2.78	.006	0.16	2.29	0.07	.945	0.24	.10	2.43	.016
SDO x Intergroup threat	4.69	2.38	1.97	.049	0.94	2.79	0.34	.735	0.22	.13	1.75	.080
ID	2.61	1.50	1.74	.083	0.54	2.16	0.25	.801	0.19	.09	2.08	.038
ID x Climate change threat	2.79	2.50	1.12	.264	1.97	2.73	0.72	.479	-0.03	.14	-0.20	.842
ID x Intergroup threat	5.67	2.24	2.53	.012	0.58	2.95	0.20	.845	0.07	.12	0.59	.549
Political orientation	4.06	0.99	4.07	< .001	-5.12	1.04	-4.89	< .001	0.30	.05	5.81	< .001
Model summaries	$R^2 = .52, F(9,368) =$				$R^2 = .33, F(9,368) =$				$R^2 = .56, F(9,368) =$			
	68.90, $p < .001$				21.44, $p < .001$				73.05, $p < .001$			

Notes. ID = Ingroup identification; SDO = Social Dominance Orientation. Continuous variables (in-group identification and social dominance orientation) are centered. Significant effects are displayed in bold. The covariate variable (Political Orientation) was allowed to correlate with both moderators and the outcome variables. Only main effects and significant

two-way interactions were included. However, the analyses were also conducted with all three-way interactions. These interactions were not significant, and model-change statistics indicate that the addition of these interaction terms did not improve the predictive ability of the models. These higher-order interactions are not discussed in this manuscript.

The interaction between the intergroup threat condition and SDO in predicting modern racism (H3e) was not significant at the $< .05$ level ($b = 0.22$, 95%CI $[-0.03, 0.47]$, $t(368) = 1.75$, $p = .080$).

With to ingroup identification, in the first moderation, with intergroup threat perceptions as the dependent variable, the interaction between ingroup identification and the intergroup threat condition was significant (H4d). Simple slopes showed that, when participants read about intergroup threats, higher ingroup identification predicted ($b = 5.67$, 95%CI $[1.26, 10.07]$, $t(368) = 2.53$, $p = .012$) higher intergroup threat perceptions (see Fig. 2). No significant interaction with the climate change threat condition was found (H4b). For climate change threat perceptions and modern racism as dependent variables, no significant interaction with either condition was found (H4a & H4e).

Running Head: CLIMATE CHANGE, IDENTITY, AND SOCIAL DOMINANCE

Figure 2. Simple slopes for interactions between Social Dominance Orientation (upper row), ingroup identification (lower row) and the experimental conditions (Study 1). Ribbons represent 95% confidence intervals. SDO and ID were centered prior to the analysis.

Discussion Study 1

In Study 1, we tested the effects of experimentally induced climate change and intergroup threats (i.e., news article) on subjective climate change and intergroup threats threat perceptions and modern racism. We were particularly interested in exploring generalization *effects* in which (a) threat-cues pertaining to climate change would increase intergroup threat perceptions and modern racism and (b) intergroup threat-cues would increase climate change threat perceptions. Moreover, we tested the moderating role of ingroup identification and SDO as *antecedents* of threat perceptions and modern racism.

Main effects. In line with previous research (e.g., Fritzsche, Cohrs, Kessler, & Bauer, 2012; Uhl, Jonas, & Klackl, 2016; Uhl, Klackl, Hansen, & Jonas, 2018), we found that when participants read the news article containing climate change threat-cues, subjective intergroup threat perceptions and modern racism did significantly increase. Thus, our study replicates and extends previous findings on generalization effects with intergroup threat perceptions and modern racism as downstream consequences. We also tested whether reading news containing intergroup threat-cues would affect climate change threat perceptions. Only a marginally significant generalization effect ($p = .052$) was found when participants read about intergroup threats due to immigration on climate change threat perceptions. Thus, our results suggest that the generalization effect may also occur in the reverse direction.

Moderation and generalization effects. As hypothesized, SDO showed direct effects on threat appraisals and modern racism, independent of the threat manipulation, thus supporting our hypothesis regarding its antecedent nature. Moreover, in line with

our hypothesis, we found a significant interaction between SDO and the climate change threat manipulation. Specifically, SDO significantly moderated the generalization effect between climate change threat-cues and intergroup threat perceptions and modern racism, such that climate change threat-cues increased intergroup threat perceptions and modern racism as a function of SDO. Furthermore, as expected, we found a significant interaction between SDO and the intergroup threat condition in predicting higher intergroup threat perceptions. Contrary to our hypothesizing, however, while SDO did significantly predict decreased climate change appraisals, no significant moderation for the effects of climate change threat-cues on subjective climate change appraisals was indicated.

In contrast to SDO, our results suggest that ingroup identification did not independently predict either threat perception. This indicates that ingroup identification did not influence threat perceptions as an antecedent factor. Also, contrary to our hypothesis, ingroup identification did not moderate the generalization effect between climate change threat-cues and intergroup threat perceptions and modern racism. However, in line with our hypotheses and previous research (e.g., Bizman & Yinon, 2001), we found a direct effect of ingroup identification on modern racism and an interaction between ingroup identification and the intergroup threat condition predicting higher intergroup threat perceptions. In addition, we also assessed subjective threat perceptions on three different levels, i.e., personal, national-group, and global. Based on self-categorization theory, we expected to find that climate change threat-cues would result in higher group-level intergroup threat perceptions as a function of ingroup identification. Contrary to self-categorization theory assumptions, we did not find a

significant interaction between climate change threat-cues and ingroup identification at any level of threat-appraisal (see SOM, S5 and Table S6).

A possible explanation for the non-significant findings for ingroup identification might be that ingroup identification is not an *antecedent* of threat perceptions but rather is itself responsive to threat-cues itself. This perspective aligns with Social Identity Theory (Tajfel & Turner, 1986) which suggests that ingroup identification is responsive to external threat-cues and interacts with threats in predicting various downstream consequences of threat. This reasoning is also explicitly included in the threat and defense literature which posits that not only outgroup derogation but ingroup identification itself can increase as a result of processing information containing collective threat-cues. As mentioned in the introduction (see Footnote 1), the threat and defense literature in general frequently uses the term *ethnocentrism* to refer to both ingroup bias (e.g., ingroup favoritism, ingroup identification, self-categorization) as well as to outgroup derogation (e.g., prejudice) simultaneously. This is a somewhat problematic conflation of concepts which have been shown to be psychologically distinct, albeit entangled processes (e.g., Brewer, 1999; Levin & Sidanius, 1999). More to the point, previous findings indicate that ingroup bias does not necessarily translate into intergroup threat perceptions and outgroup derogation. Hence, we analyze ingroup identification and outgroup derogation as distinct phenomena. To this end, following a social identity theory approach in Study 2, we aimed at further exploring whether ingroup identification itself is responsive to collective threat-cues and whether it interacts with threat-cues in predicting higher threat perceptions and modern racism.

Study 2

The main aim of Study 2 was to replicate our findings from Study 1, this time however, assessing SDO and ingroup identification within Study 2 itself, as posterior factors after administering our threat manipulations. Furthermore, in Study 2, we aimed at replicating our findings in a different national context (UK) to test our hypotheses and findings cross-nationally. Lastly, we further included a measure of pro-environmental behavior, namely, behavioral collective action support as dependent variable. Previous research has shown that information containing climate change threat-cues increases pro-environmental behavioral intentions. Here, we advance previous research by employing a more behavioral measure (i.e., signing ostensibly real online petitions in support of climate change mitigation policies). Thus, we test whether climate change threat cause increased actual pro-environmental behavior. In addition to our hypotheses from Study 1, in Study 2, we further preregistered and tested the following hypotheses. Figure 3 depicts our hypotheses. A detailed overview of our hypotheses for Study 2 is presented in the SOM (S-Hypotheses 2).

Figure 3. Illustration of the hypothesized effects of externally manipulated threat-cues (vs. no-threat control group) on subjective threat perceptions (climate change and intergroup threats) modern racism, and pro-environmental behaviour, as moderated by social dominance orientation, and ingroup identification, controlling for political orientation (not displayed in Figure). Dotted lines represent generalization effects.

Methods

Participants. The present study was pre-registered (see: <https://aspredicted.org/blind.php?x=sx97w9>). Following our power calculations (see SOM, S1), we recruited 680 participants in the UK using Prolific in November 2020. Participants received £1.50 payment each (£6.45 per hour rate), as compensation for their time and effort. Participants were asked to answer an attention check question by choosing one specific answer option at the beginning of the survey. Participants who failed the quality check were excluded. In total 27 participants were removed due to

failing the attention check (as pre-registered), resulting in a final sample size of 653.

The sample consisted of 285 female participants (43.6 %) and the average age was 35.72 ($SD = 12.61$). Detailed descriptive statistics, quality checks, and power analyses are provided in the SOM (S1-S2).

Study design. Study 2 was identical to Study 1 except for the following changes. First, the study collected data in the UK. Thus, we adapted our manipulation materials to pertain to the UK instead of the USA. Specifically, we kept the climate change (e.g., wildfires, floods, resources scarcity, health etc.) and Muslim immigration (social and cultural issues) threat-cues, the news outlet (i.e., BBC), the titles, and the length of the articles the same across studies and only changed the country to be UK instead of the USA. The control group received the same news article as in Study 1 (see SOM-Stimuli Study 2 for materials). Second, as we described in the previous section, we assessed SDO and ingroup identification after the threat manipulations instead of using data from an earlier study pool. SDO and ingroup identification were presented in randomized order. Third, in addition to the measures used in Study 1, we also included a measure pro-environmental behavior (i.e., signing online petitions), to assess actual pro-environmental collective action behavior.

Materials and procedure. As in Study 1, after reading one of the three articles, participants were asked comprehension questions, then responded to news perceptions (i.e., agreement with the news article) and manipulation checks (e.g., alarming; $\alpha = .92$). Next, participants responded to different affective states they might have experienced during the last week (i.e., anger [$\alpha = .94$], fear [$\alpha = .96$], guilt [$\alpha = .89$], sadness [$\alpha = .92$]; see SOM 7 for detailed EFA results). Next, we administered measures of ingroup

identification ($\alpha = .96$) and SDO ($\alpha = .96$) in randomized order. Afterwards, participants responded to measures of subjective climate change threat perceptions ($\alpha = .94$; see SOM 7 for EFA results), intergroup threat perceptions ($\alpha = .94$; see SOM 7 for EFA results), modern racism ($\alpha = .94$), pro-environmental behavior (i.e., collective action support), provided demographic information, and were debriefed.

Signing of pro-environmental online petitions. As a behavioral measure of climate-change-mitigation collective action support, we adopted a measure from a study by Uenal and colleagues (2020; adopted from a study by Kteily, Hodson, and Bruneau, 2016). This measure is a multi-item behavioral measure in which participants are asked whether they agree to be added as a signatory in different (realistic, but fictional) online petitions via their associated Prolific ID. Participants were provided with three options: support, non-support, or non-inclusion (e.g., “Add my Prolific ID to the petition”, scored as 1, “Add my Prolific ID in opposition to the petition”, scored as -1, or “Do not add my Prolific ID to the petition”, scored as 0, respectively). The content of the petitions is similar to existing petitions and pertain to urging members of parliament to enact measures to mitigate climate change related negative consequences (e.g., “Urge members of parliament to increase spending on combating global climate change for the protection of the natural environment”; $\alpha = .92$).

Results

Table 5 shows the mean scores, standard deviations, and inter-correlations among all variables. All the measures showed significant inter-correlations in the expected direction. Correlations between variables in each condition can be found in the SOM (Table S8).

Table 5

Correlations Between Variables Across All Groups (Study 2)

Measures	<i>M</i>	<i>SD</i>	2.	3.	4.	5.	6.	7.
1. Social dominance orientation	2.54	1.38	.21***	.54***	-.46***	.58***	-.29***	.53***
2. Ingroup identification	4.87	1.39		.39***	-.13**	.38***	-.12**	.39***
3. Intergroup threat perceptions	29.32	29.68			-.16***	.83***	-.19***	.49***
4. Climate change threat perceptions	65.82	30.14				.32***	.26***	-.47***
5. Modern racism	3.25	1.76					-.21***	.57***
6. Signing online petitions	0.54	0.56						-.34***
7. Political orientation	3.45	2.01						—

Note. ** $p < .01$, *** $p < .001$

Main effects.¹¹ Next, following the same procedure as in Study 1, we ran an Analysis of Variance Analysis (ANOVA) to assess the effects of the threat manipulations on each dependent variable individually. The results are summarized in Table 6 and suggest the manipulations were successful as indicated by significant differences for the main variables of interest. Replicating Study 1, participants in both threat conditions showed more agreement with the news than participants in the control condition.

¹¹ As a first step, we performed a multivariate analysis of variance (MANOVA) to help protect against inflating the Type 1 error rate in the follow-up ANOVAs and to test the hypothesis that there would be one or more mean differences between our threat manipulation conditions (control, climate change threat, intergroup threat) and our dependent variables. As shown in Table 5, a meaningful pattern of correlations was observed amongst most of the dependent variables (between -.46 - .58), suggesting the appropriateness of a MANOVA. A statistically significant MANOVA effect was obtained, $F(24, 1280) = 29.29$, $p < .001$; Pillais' Trace = .71, partial $\eta^2 = .35$. The multivariate effect size was estimated at .709, which implies that 35.4% of the variance in the canonically derived dependent variable was accounted for by the threat manipulations.

Table 6

Between-Group Differences Across Conditions (Study 2).

Measures	Control		Climate change		Intergroup threat			
	condition		condition		condition			
	(n = 212)		(n = 218)		(n = 223)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	η_p^2
News perception	3.77 _{a,b,c}	0.88	4.18 _{a,b,c}	1.11	3.08 _{a,b,c}	1.27	56.82***	.149
Agreement news	1.70 _{d,e,f}	0.83	4.15 _{d,e,f}	1.01	3.58 _{d,e,f}	1.08	367.49***	.531
Ingroup identification	4.82	1.37	4.90	1.43	4.89	1.36	0.25	.001
Social dominance orientation	2.47	1.39	2.51	1.42	2.63	1.34	0.73	.002
Perceived threat								
Climate change	62.12 _g	29.99	69.79 _g	29.70	65.46	30.37	3.53*	.011
Intergroup	19.31 _{h,i}	22.52	34.10 _h	32.33	34.16 _i	30.70	18.82***	.055
Affective States								
Anger	4.40	1.80	4.64	1.76	4.55	1.65	1.08	.003
Fear	4.60	1.88	4.93	1.74	4.72	1.73	1.94	.006
Sadness	3.79	1.75	4.09	1.71	3.86	1.68	1.92	.006
Guilt	2.71	1.85	2.98	1.91	3.08	1.87	2.17	.007

Modern Racism	2.83 _{j,k}	1.55	3.41 _j	1.83	3.49 _k	1.81	9.49***	.028
Signing online petitions	0.55	0.55	0.54	0.58	0.52	0.56	0.19	.001

** $p < .05$, *** $p < .001$

Notes. The reference group is the control condition. Within rows, means with the same subscripts are significantly different with Bonferroni corrections. Their specific significance levels are as follows: ^{a-f} $p < .001$, ^g $p < .05$, ^{h-i} $p < .001$, ^j $p < .01$, ^k $p < .001$

Furthermore, participants in the climate change condition found the news more alarming compared to the control condition. Moreover, the results showed no differences in affective states across conditions and thus, the experimental manipulations did not generalize onto participants' self-reported affective states. Replicating the results from Study 1, post-hoc tests with Bonferroni correction indicated that climate change threat-cues elicited significantly higher climate change threat perceptions (H1a), intergroup threat perceptions (H1b), and higher levels of modern racism (H1c) compared to the control condition. In accordance with our hypothesis (H2a & H2b) and replicating Study 1, intergroup threat-cues evoked significantly higher levels of intergroup threat perceptions and modern racism than the control group. In contrast to Study 1, participants in the intergroup threat condition also showed significantly higher climate change threat perceptions (H6b), thus indicating generalization effects in both directions (only marginally significant in Study 1; $p = .052$). Contrary to our hypothesis (H5a & H6a), ingroup identification showed no significant difference between the conditions. This finding indicates that the threat manipulations did not significantly increase ingroup identification as hypothesized based on social identity theory. No significant difference for SDO and signing online petitions (H5b) was indicated either.

As in Study 1, we also ran an ANOVA to test for differences in threat appraisals on the individual, national-group, and global levels. As shown in Table 7, participants perceived climate change threats the lowest at the personal level followed by higher levels on the national-group level and the highest for on the global level. For intergroup threats, participants perceived higher threats on the country and world levels compared

to the personal level. In contrast to climate change threats however, threat perceptions were higher on the country level compared to the World level.

Table 7

Between-Group Differences in Threat Perceptions Across Conditions (Study 2)

Measures	Control		Climate change		Intergroup threat			
	condition		condition		condition			
	(n = 212)		(n = 218)		(n = 223)			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i>	η_p^2
Climate change threat								
perceptions								
Personal	52.71 _a	32.84	61.63 _a	33.33	57.92	34.19	3.85**	.012
UK	63.14 _b	31.14	71.19 _b	30.74	65.74	30.91	3.81**	.012
World	70.52	31.07	76.55	29.83	72.71	30.55	2.17	.007
Intergroup threat								
perceptions								
Personal	12.76 _{c,d}	26.75	27.11 _c	31.60	26.00 _d	29.83	18.21***	.053
UK	22.84 _{e,f}	26.62	38.72 _e	35.88	38.73 _f	33.59	17.29***	.051
World	22.34 _{g,h}	27.38	36.48 _g	35.23	37.76 _h	33.85	14.99***	.044

** $p < .01$, *** $p < .001$

Notes. The reference group is the control condition. Within rows, means with the same subscripts are significantly different with Bonferroni corrections. Their specific significance levels are as follows: ^{a-b} $p < .01$, ^{c-h} $p < .001$.

Moderation by SDO and ingroup identification. Following the same procedure as in Study 1, to test our hypotheses on the moderation effects, we performed four regression analyses on our dependent variables using the PROCESS macro (Version 3.3) by

Hayes (2018) for a multi-categorical moderation analysis (Model 2¹²). The three experimental conditions represented by two dummy-coded variables for the climate change threat/intergroup threat (vs. control) conditions were entered as predictors along with SDO (centered) and ingroup identification (centered), and the respective two-way interactions. Political orientation was entered as covariate. The indicator-approach for the multi-categorical independent variable coded into two dummy variables (D1: 0 = Control, 1 = Climate change threat, 0 = Intergroup threat; D2: 0 = Control, 0 = Climate change threat, 1 = Intergroup threat) was used as well as bootstrapping with 5,000 random re-samples to estimate 95% confidence intervals for the interaction effects (see Table 8). Multicollinearity diagnostics for each model showed a $VIF_{Max} = .154$ indicating no multicollinearity issues. In line with our expectations (H1a-H1c) and replicating Study 1, the climate change condition showed a significant positive effect on our three dependent variables but not on the online petitions signing variable (H5b) (see Table 8). In the same vein, the intergroup threat condition showed significant positive effects on intergroup threat perceptions and modern racism (H2a-2b).

¹² Here, we present the results for the aggregated threat perception constructs. As in Study 1, we also ran regression analyses using the threat items at different level of threat perception (e.g., personal, group, global levels). In sum, SDO showed a significant interaction with the climate change condition in predicting higher intergroup threat perceptions on the personal and group levels of threat perceptions. In contrast, ingroup identification showed only significant interaction with the climate change condition on the personal level but not on the group or global level of intergroup threat perception. Thus, analyzing the threat perceptions on different levels of threat appraisal showed no moderation of generalization effects by ingroup identification on the group level (H8b). We present detailed results on these analyses in the SOM (see S9 and Table S10 in the SOM).

Table 8

Regression Analyses Predicting Subjective Threat Perceptions, Modern Racism, and Pro-Environmental Behavior.

	Intergroup Threat				Climate Change Threat				Modern Racism				Signing Online Petitions			
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Climate change threat dummy	14.16	2.12	6.67	< .001	8.29	2.39	3.46	< .001	0.54	0.12	4.42	< .001	0.00	0.05	0.00	.998
Intergroup threat dummy	12.85	2.01	6.39	< .001	5.26	2.49	2.11	.035	0.53	0.12	4.35	< .001	-0.01	0.05	-0.19	.848
SDO	5.48	1.25	4.39	< .001	-6.14	1.39	-4.40	< .001	0.34	0.08	4.24	< .001	-0.07	0.03	-2.59	.009
SDO x Climate change threat	3.87	1.66	2.33	.020	-1.21	1.84	-0.66	.512	0.22	0.09	2.32	.021	0.00	0.04	0.13	.892
SDO x Intergroup threat	3.85	1.85	2.07	.038	0.18	2.09	0.08	.933	0.21	0.11	1.95	.051	0.02	0.04	0.63	.529
ID	2.19	1.09	1.99	.046	-1.16	1.45	0.80	.421	0.17	0.08	2.17	.030	0.01	0.02	0.56	.576
ID x Climate change threat	3.47	1.77	1.96	.050	4.07	1.88	2.17	.031	0.03	0.10	0.28	.780	-0.01	0.03	-0.37	.712
ID x Intergroup threat	4.32	1.57	2.74	.006	3.26	2.05	1.59	.113	0.09	0.10	0.89	.374	-0.01	0.03	-0.45	.651
Political orientation	2.79	0.64	4.35	< .001	-5.08	0.69	-7.38	< .001	0.26	0.04	7.00	< .001	-0.07	0.01	-5.23	< .001
Model summaries	$R^2 = .45, F(9,643) =$				$R^2 = .31, F(9,643) =$				$R^2 = .49, F(9,643) =$				$R^2 = .13, F(9,643) =$			
	79.90, $p < .001$				34.29, $p < .001$				108.48, $p < .001$				10.69, $p < .001$			

Notes. ID = Ingroup identification; SDO = Social Dominance Orientation. Continuous variables (in-group identification and social dominance orientation) are centered. Significant effects are displayed in bold. The covariate variable (Political Orientation) was allowed to correlate with both moderators and the outcome variables. Only main effects and significant two-way interactions were included. However, the analyses were also conducted with all three-way interactions. These interactions were not significant, and model-change statistics indicate that the addition of these interaction terms did not improve the predictive ability of the models. These higher-order interactions are not discussed in this manuscript.

In contrast to Study 1, the intergroup threat condition also showed a significant effect (H6b) on climate change threat perceptions as well (in Study 1 we found only a marginally significant effect, $p = .052$).

Replicating our results from Study 1 and in line with our expectations, SDO showed a significant effect in predicting lower climate change threat perceptions (H3a) and higher intergroup threat perceptions (H3b) and higher modern racism (H3c), controlling for the effects of ingroup identification and political orientation (H9). SDO also significantly predicted lower signing of online petitions aimed at climate change mitigation policy support. As in Study 1, ingroup identification showed a significant effect on modern racism. In contrast to Study 1, ingroup identification also significantly predicted higher intergroup threat perceptions.

In the first moderation, with intergroup threat perceptions as the dependent variable, the interaction between SDO and the climate change condition was significant (H3b). Simple slopes showed that, when participants read about the consequences of climate change on the UK, higher SDO predicted ($b = 3.87$, 95%CI [0.61, 7.13], $t(643) = 2.33$, $p = .020$) higher intergroup threat perceptions (see Fig. 4). Similarly, when participants read about intergroup threats, higher SDO also predicted ($b = 3.85$, 95%CI [0.20, 7.49], $t(643) = 2.07$, $p = .038$) higher intergroup threat perceptions (H3d). In the second moderation, with climate change threat perceptions as dependent variable, no significant interaction with either condition was found (H3a). In the third moderation, with modern racism as dependent variable, the interaction between SDO and the climate change condition was significant (H3c). Simple slopes showed that, when participants read about climate change, higher SDO predicted higher modern racism ($b = 0.22$,

95%CI [0.33, 3.99], $t(643) = 2.32$, $p = .021$) (see Fig. 6). The interaction between the intergroup threat condition and SDO in predicting modern racism (H3e) was only marginally significant ($b = 0.22$, 95%CI [-0.00, 0.43], $t(643) = 1.95$, $p = .051$). In the fourth moderation, with signing online petitions as dependent variable (H7a), no significant interaction with either condition was found.

In regard to ingroup identification as moderator, in the first moderation, with intergroup threat perceptions as the dependent variable, the interaction between ingroup identification and the intergroup threat condition was significant (H4d). Simple slopes showed that, when participants read about intergroup threats, higher ingroup identification predicted ($b = 4.32$, 95%CI [1.23, 7.41], $t(643) = 2.74$, $p = .006$) higher intergroup threat perceptions (see Fig. 4). The interaction between the climate change threat condition and ingroup identification in predicting intergroup threat perceptions (H4b) was only marginally significant ($b = 3.47$, 95%CI [-0.00, 6.96], $t(643) = 1.96$, $p = .050$). In the second moderation, with climate change threat perceptions as dependent variable, the interaction between ingroup identification and the climate change threat condition was significant (H4a). Simple slopes showed that, when participants read about climate change threats, higher ingroup identification predicted ($b = 4.07$, 95%CI [0.38, 7.76], $t(643) = 2.17$, $p = .031$) higher climate change threat perceptions (see Fig. 4). No significant interaction with the intergroup threat condition was found. In the third and fourth moderation, with modern racism and signing online petitions as dependent variable, no significant interaction with either condition was found (H4c & H8a).

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Figure 4. Simple slopes for interactions between Social Dominance Orientation (upper row), ingroup identification (lower row) and the experimental conditions (Study 1). Ribbons represent 95% confidence intervals. SDO and ID are centered.

Discussion Study 2

Study 2 successfully replicated our main findings from Study 1 in a different national setting (UK). Our new hypotheses for Study 2 were partially supported.

Main effects. Replicating Study 1, the results of Study 2 indicate that participants who were exposed to information containing climate change threat-cues showed significantly higher climate change threat and intergroup threat perceptions as well as higher modern racism. Moreover, in accordance with Study 1, participants in the intergroup threat condition showed higher intergroup threat perceptions and modern racism. A noteworthy difference compared to Study 1 was that experimentally manipulated intergroup threat-cues also showed generalization effects onto climate change threat perceptions such that participants reading about intergroup threats due to Muslim immigration to the UK showed significantly higher subjective climate change threat perceptions. In Study 1, this association was only marginally significant ($p = .052$). Hence, the results from Study 2 suggest that generalization effects can in fact occur in both directions (climate change threat $\Leftrightarrow$ intergroup threat). Moreover, for Study 2, we also assessed pro-environmental collective action behavior (i.e., signing online petitions) and expected to see differences in this measure across conditions. Contrary to our expectation, however, no significant differences for pro-environmental collective action behavior were observed. Moreover, based on social identity theory, for Study 2, we expected to find that individuals in both threat conditions (vs. control) would show higher ingroup identification as a result of the threat manipulations. This hypothesis was also not supported by the data.

Moderation and generalization effects. Study 2 successfully replicated our findings from Study 1 with regard to the moderation and generalization effects. Specifically, in accordance with Study 1, SDO showed a significant positive effect on intergroup threat perceptions and modern racism while negatively predicting climate change threat perceptions *ceteris paribus*. SDO also negatively predicted pro-environmental collective action behavior, as expected for Study 2. In line with Study 1, SDO significantly moderated the generalization effect between climate change threat-cues and intergroup threat perceptions and modern racism. As in Study 1, and contrary to our expectations, no significant interaction between SDO with either threat condition was observed in predicting climate change threat perceptions.

In regard to ingroup identification, replicating Study 1, ingroup identification showed a significant positive effect on modern racism. Moreover, in accordance with Study 1, ingroup identification significantly interacted with the intergroup threat condition in predicting higher intergroup threat perceptions. Contrary to our novel expectations for Study 2, we did not find a significant association between ingroup identification and our new dependent variable, namely, pro-environmental collective action behavior. Some noteworthy differences compared to Study 1 were observed for ingroup identification. First, in contrast to Study 1, ingroup identification did show a significant positive effect on intergroup threat perceptions independent of the threat manipulation. In Study 1, when ingroup identification was measured 2 years prior to the threat manipulation, no significant effect was indicated. This finding is in line with Social Identity Theory (Tajfel & Turner, 1986). Another noteworthy difference is that in Study 2, in line with our hypothesis, ingroup identification showed a significant interaction with the climate

change threat condition in predicting higher climate change threat perceptions. Individuals highly identified with their national ingroup reacted with higher climate change threat perceptions upon reading news on the negative consequences of climate change on their nation. Lastly, in contrast to Study 1, we found a marginally significant interaction ($p = .050$) between the climate change threat condition and ingroup identification in predicting higher intergroup threat perceptions (i.e., generalization effect), as posited in the threat and defense literature. While the data did not show an increase in mean levels of ingroup identification itself, the marginally significant interaction with the climate change condition in predicting higher intergroup threat perceptions suggest that increased outgroup bias might be moderated by ingroup identification.

General Discussion

Though climate change threat perceptions are a potent predictor of pro-environmental attitudes, they also show unintended side effects such as increased outgroup derogation. Here, we sought to investigate two previously untested psychological moderators which might explain why climate change threats increase pro-environmental behaviors for some individuals while (also) increasing outgroup derogation for others. Previous work within the threat and defense literature (Jonas et al., 2014) has focused on defensive *coping* mechanisms such as buffering existential anxiety or restoring a sense of personal control, certainty, meaning, or belonging as explanations for these diverging outcomes. In the current work, we investigated whether SDO (i.e., personal generalized ideology) and ingroup identification (i.e., social identity theory and self-categorization theory) moderate diverging threat-responses. Our main

hypothesis was that ingroup identification and SDO should moderate the generalization effects such that climate change threat-cues should elicit higher intergroup threat perceptions and higher modern racism for individuals scoring relatively high ingroup identification and SDO. By connecting SDO and group identity perspectives to research on climate change threats and associated generalization effects, we add to the growing threat and defense literature (e.g., Jonas et al., 2014; Fritzsche, Jonas, & Kessler, 2011) and show how collective threats and attitudinal and behavioral threat-responses are crucially shaped by personal preferences for hierarchy and dominance and group identity processes (Stephan & Renfro, 2002; Uenal et al., 2021).

Collective threats and generalization effects

In line with previous research (e.g., Fritzsche et al., 2012; Uhl, Jonas, & Klackl, 2016; Uhl, Klackl, Hansen, & Jonas, 2018), across two studies we show that participants who were exposed to information containing climate change threat-cues showed significantly higher climate change threat and intergroup threat perceptions as well as higher modern racism. Thus, our study replicates and extends previous findings on generalization effects by analyzing intergroup threat perceptions and modern racism as socially important downstream consequences. Conversely, we also show that participants who were exposed to information containing intergroup threat-cues displayed higher intergroup threat perceptions as well as higher modern racism. Notably, we also tested whether exposure to intergroup threat-cues would affect climate change threat perceptions. Previous research had only analyzed generalization effects from climate change (or economic crisis) onto intergroup attitudes (e.g., outgroup derogation) but not the other way around (intergroup threats -> climate change threat

perceptions). In Study 1, we found a marginally significant generalization effect ($p = .052$) of intergroup threat-cues on climate change threat perceptions. In Study 2, our results show that experimentally manipulated intergroup threat-cues did significantly show generalization effects on climate change threat perceptions such that participants reading about intergroup threats due to Muslim immigration to the UK showed significantly higher subjective climate change threat perceptions. Hence, the results from Study 2 suggest that generalization effects can in fact occur in both directions (climate change threat $\Leftrightarrow$ intergroup threat). This finding is line with previous research which postulates that different types of threats can generalize without necessarily invoking feelings of existential anxiety for example (Navarrete et al., 2004). Lastly, we hypothesized and tested (Study 2) whether climate change threat-cues would increase *actual* pro-environmental collective action behavior (i.e., signing online petitions). Our results showed no increase in pro-environmental behavior across conditions. Thus, complementing previous research, our results suggest that previous findings on climate change threat-cues increasing behavioral intentions and pro-environmental attitudes might not necessarily translate into actual behavioral changes.

Ingroup identification, collective threats, and modern racism / environmentalism

Based on previous research on ingroup identification and threat appraisals (e.g., Fritzsche, Jonas, & Kessler, 2011; Fritzsche et al., 2013; Riek, Mania, & Gaertner, 2006), we hypothesized that ingroup identification would be positively related to climate change threat and intergroup threat perceptions as well as positively related to modern racism and pro-environmental behavior. Importantly, based on self-categorization theory (Turner & Reynolds, 2003), we posited that ingroup identification would be an

antecedent of our dependent variables and, as such, should predict threat appraisals *independent* of the external threat manipulations. In Study 1, when ingroup identification was assessed as antecedent factor prior to the experimental manipulation, it was significantly predictive of modern racism, controlling for the effects of SDO and political orientation. However, our results suggest that ingroup identification did not *independently* predict either threat perception. In Study 2, following social identity theory, when ingroup identification was measured directly after the manipulation as posterior factor, we found a significant independent effect of ingroup identification on intergroup threat perceptions ($p = .046$) and modern racism but not on climate change threat perceptions or pro-environmental behavior. Moreover, in line with our expectations and previous research (e.g., Bizman & Yinon, 2001; Tausch, Hewstone, Kenworthy, Cairns, & Christ, 2007), across both studies, ingroup identification significantly interacted with the intergroup threat manipulation in predicting increased intergroup threat perceptions. Taken together, our results did not support the notion of ingroup identification as antecedent of threat perceptions (c.f., Riek, Mania, & Gaertner, 2006; Turner & Reynolds, 2003). Rather, our results speak more in favor of Social Identity Theory (SIT; Tajfel & Turner, 1986). SIT posits that individuals who are highly identified with their ingroup are more attuned to information containing threat-cues pertaining to their ingroup. In turn, highly identified individuals are more receptive to ingroup threat-cues and show affective responses consistent with their adherence to their ingroup when social identity is salient (Branscombe & Wann, 1994; Fischer, Haslam, & Smith, 2010). In this vein, a further finding in support of SIT is that ingroup identification significantly interacted with the climate change condition in predicting

higher climate change threat perceptions (Study 2). This finding indicates that climate change threats to the national ingroup can be perceived as a function of ingroup identification. In other words, for people highly identified with their national ingroup, climate change threat-cues pertaining to the national group-level resulted in pronounced subjective climate change threat perceptions.

Regarding the generalization effects, following findings from the threat and defense literature (Jonas et al., 2014), we hypothesized that ingroup identification should moderate generalization effects between climate change threat-cues and intergroup threat perceptions and modern racism. Contrary to this hypothesis, in Study 1, when ingroup identification was measured as antecedent (i.e., prior to the threat manipulation), ingroup identification did not significantly moderate these generalization effect. In Study 2, when ingroup identification was measured after the threat manipulation, we further hypothesized that ingroup identification should increase as a response to threat-cues as well as interact with the climate change threat manipulation. While we did not find support for increased ingroup identification as a consequence of threat-cues, we did find a marginally significant interaction with the climate change condition ($p = .050$) predicting higher intergroup threat perceptions. Ingroup identification showed no significant effect on pro-environmental behavior.

Overall, our results did not support all of our hypotheses which we generate based on self-categorization theory. Specifically, our results did not support ingroup identification as antecedent of threat perceptions (Study 1), controlling for SDO and political orientation. Neither did our data support the hypothesis that ingroup identification would moderate the generalization effects as antecedent, *ceteris paribus*.

To test an alternative hypothesis based on the social identity theory, we tested whether ingroup identification itself would increase as a result of threat-cues. Our data did not support this hypothesis either (Study 2). However, in Study 2, we did find a marginally significant interaction between ingroup identification and the climate change threat condition ($p = .050$) predicting higher intergroup threat perceptions. The latter result from Study 2 might cautiously be interpreted in support of social identity theory within the threat and defense literature reasoning.

SDO, collective threats, and modern racism/environmentalism

As an alternative explanation to the social identity and self-categorization models, we hypothesized that SDO would be positively related to intergroup threat perceptions and modern racism but negatively related to climate change threat perceptions and pro-environmental behaviors, controlling for the effects of ingroup identification and political orientation. Importantly, in the same manner as for ingroup identification, we posited that SDO would be an antecedent predisposition of our dependent variables and, as such, should predict threat appraisals and modern racism *independent* of the threat manipulation. Indeed, SDO was significantly predictive of our dependent variables in the hypothesized direction, both, when assessed as antecedent two years prior (Study 1), and as posterior factor, assessed immediately after the manipulation (Study 2), controlling for the effects of ingroup identification and political orientation. Thus, our results support the notion of SDO as antecedent of threat perceptions, both pertaining to climate change and intergroup threat perceptions, as well as modern racism and pro-environmental behaviors (Stephan & Renfro, 2002; Uenal, 2016; Uenal et al., 2021). These results advance research on the relationship

between social dominance orientations and socio-environmental issues by showing how preferences for hierarchies and dominance generalize and crucially shape attitudes and behaviors across relational domains (i.e., intergroup relations and human-environment relations).

Against this background, we furthermore hypothesized that SDO should moderate the generalization effect between climate change threat-cues and intergroup threat perceptions and modern racism. Indeed, across both studies, we show that SDO moderates the observed generalization effects such that participants reading the news article on climate change showed increased intergroup threat perceptions and modern racism in conjunction with higher SDO scores, *ceteris paribus*. It is important to note that the significant moderation by SDO occurred both when SDO was measured 2 years prior (Study 1) as well as immediately after (Study 2) the threat manipulation. Equally noteworthy, SDO did not significantly change (i.e., increase) as a result of the threat manipulations (Study 2). These findings are in line with previous research which indicates that SDO is a relatively stable (Kunst et al., 2017; Sidanius et al., 2017) and partially heritable psychological feature (Kleppetø et al., 2019) and lends further support to its antecedent nature. In line with previous research, we also hypothesized that SDO would also interact with the intergroup threat manipulation in predicting increased intergroup threat perceptions and modern racism (Duckitt & Sibley, 2017). Indeed, across two studies SDO significantly interacted with the intergroup threat manipulation in predicting increased intergroup threat perceptions.

Based on previous findings pertaining to the relationship between social dominance orientation and environmental attitudes (e.g., Jylhä & Akrami, 2015; Uenal et

al., 2021), we further hypothesized that SDO should also moderate the effects of climate change threat-cues on climate change threat perceptions such that participants reading the news article containing climate change threat cues would show lower subjective climate change threat perceptions and decreased pro-environmental behaviors in conjunction with higher SDO scores. While our results show that SDO significantly negatively predicted decreased climate change threat perceptions and lower pro-environmental behavior—as expected—no significant interaction was observed between the climate change threat manipulation and SDO in predicting climate change threat perceptions.

Limitations and future research

Some caveats are important to consider. First, the threat and defense literature propose several distinct pathways of generalization by providing a very broad definition of ethnocentric tendencies and operationalizing it both as a potential outcome of collective threats as well as a moderator between collective threats and further downstream consequences. As previously mentioned, the ethnocentrism concept is defined not only in terms of ingroup identification but also as ingroup bias, ingroup favoritism, self-stereotyping, ingroup norm compliance, aggression against ingroup norm-violators, ingroup agency, ingroup homogeneity, outgroup derogation, and prejudice (Fritzsche, Jonas, & Kessler, 2011, p. 105 & p.109). It is not feasible to cover all these potential pathways and measures in a single study and thus, here we decided to focus our attention on ingroup identification, intergroup threat perceptions, and modern racism. Future studies could test further pathways using different measures of ingroup and outgroup perceptions and attitudes.

Second, the threat and defense literature also posit that feeling a sense of loss of control and belonging might moderate between collective threats and ethnocentric tendencies. We did not test emotional responses pertaining to climate change itself in this study and thus, future research might decide to investigate the role of emotional reactions to climate change threats in conjunction with ethnocentrism. However, we did control for general affective states (PANAS) to rule out that our threat manipulations did alter the emotions of our participants. Our results did not show significant differences in fear, anger, sadness, or guilt. Nevertheless, feelings of powerlessness and control might differ, especially when assessed in conjunction with climate change perceptions.

Thirdly, although crowd-sourced samples such as from MTurk or Prolific are arguably more representative than traditional social psychological samples (Paolacci & Chandler, 2014), these samples are not fully representative.

The fourth caveat pertains to the relationship between SDO and climate change perceptions. Based on previous research (Uenal et al., 2021), we hypothesized that preferences for hierarchy and dominance should generalize across relational domains (intergroup, interspecies, and human-environment relations) and as such, SDO should moderate between climate change threat-cues and climate change threat perceptions. However, while we did find a significant association between SDO, and climate change threat perceptions no significant interaction was observed between the climate change threat manipulation and SDO in predicting climate change threat perceptions. A potential explanation for this non-significant finding may be that Ecological Dominance Orientation (EDO; Uenal et al., 2021) rather than SDO might be the key moderating factor in this specific relationship. Future research can investigate this possibility.

Conclusions and Practical Relevance

We examined the interplay between climate change and immigration threats, social dominance orientation, and ingroup identification in driving attitudinal and behavioral responses associated with climate change and immigration. As evidenced across two experiments in two national settings, differing levels in SDO played an important role in explaining why some individuals reacted with increased intergroup threat perceptions and modern racism while simultaneously displaying lower levels of pro-environmental policy support, controlling for political orientation and ingroup identification. This indicates that preferences for group-based hierarchies—as indexed by SDO—plays a constitutive role in processing climate change related threat-cues signaling increased competition for status and resources. Overall, our results suggest that understanding the role of preferences for (or opposition to) dominance and hierarchy in addition to group identities and political orientation is pivotal in potential efforts to mitigate the negative consequences of climate change and intergroup relations. We therefore encourage social, political, and environmental psychology researchers focused on the societal consequences of collective threats such as climate change to consider differing ideological orientations such as social dominance orientation in their work.

From a more practical perspective, our findings highlight the importance of understanding climate change risks not only as an environmental issue but also as a social and economic issues (see also Fritzsche et al., 2012; Uenal et al., 2021; Uhl et al., 2018). Climate change will not only accelerate environmental issues but is likely to exacerbate existing social and economic inequalities. Communicating climate change

risks would thus benefit from incorporating our findings by acknowledging the social and economic consequences of climate change and considering different communication strategies more carefully tailored to specific audiences to avoid exacerbating intergroup tensions. More research on the effects of socially contextualized climate change risk communication is urgently needed in this respect.

Open Science Practices

All study materials, data, and *SPSS* syntax files for all studies will be available (https://osf.io/v9y32/?view_only=71ac9fce55cd4731bde6b23e12a47c9e) for download on OSF; thus, this manuscript earned the Open Materials and Open Data badges.

Author Contributions

F.U. and J.S. designed the research, F.U. conducted the analysis. F.U. wrote the initial draft with inputs from J.S., J.R., and S. v. d. L.

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Supplementary Materials

Data and materials can be found on OSF:

https://osf.io/v9y32/?view_only=71ac9fce55cd4731bde6b23e12a47c9e

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S1: Participants and Power Analysis Across all Studies and Analyses

Study 1 – ANOVA (Table 2)

Following effect sizes from a previous study with a similar set-up (Fritsche et al., 2012), we determined via power analysis (G*Power, Faul et al., 2009; ANOVA: Fixed effects, special, main effects, and interaction) that a total of 369 participants are needed to have a 95% chance to observe a between-subjects effect of small to medium size $\eta p^2 = 0.04$ ($f^2 = .20$) with .80 power. To satisfy this criterion and leave some flexibility to exclude inattentive participants, we aimed at recruiting 400 participants to complete our online study using PROLIFIC in October 2020.

Study 2 – ANOVA (Table 6)

Based on the partial eta's obtained from Study 1, we determined via power analysis (G*Power, Faul et al., 2009; ANOVA: Fixed effects, special, main effects, and interaction) that a total of 636 participants would be needed to have a 95% chance to observe a between-subjects effect of small to medium size $\eta p^2 = 0.04$ ($f^2 = .20$) with .80 power. Due to multiple response variables (4 DVs in total), we further determined via power analysis for a MANOVA (G*Power, Faul et al., 2009; MANOVA: Special effects and interaction), that a total of 670 participants would be needed to have a 95% chance to observe a between-subjects effect of small to medium size $\eta p^2 = 0.04$ ($f^2 = .20$) with .80 power. Hence, to satisfy both these criteria and leave some flexibility to exclude inattentive participants, we aimed at recruiting 680 participants in UK using PROLIFIC in November 2020.

Table S2: Socio-Demographic Composition of Samples (Samples 1-2: N = 1031)**Country - Demographics**

	<i>Mean</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>	<i>N</i>
Sample 1 USA (n = 378)					
Age	45.09	13.19	20	69	378
Gender (1 = Male / 2 = Female / 3 = Other)	1.48	0.50	1	3	378
Education (1 = Low – 8 = High)	4.33	1.36	2	8	378
Household income (1 = Low – 11 = High)	3.02	1.50	1	9	378
Political orientation (1 = Very liberal / left – 7 = Very conservative / right)	3.78	1.83	1	7	378
Sample 2 UK (n = 653)					
Age	35.72	12.61	22	72	653
Gender (1 = Male / 2 = Female / 3 = Other)	1.44	0.49	1	2	653
Education (1 = Low – 8 = High)	4.33	1.32	2	8	653
Household income (1 = Low – 11 = High)	2.91	1.44	1	9	653
Political orientation (1 = Very liberal / left – 7 = Very conservative / right)	3.45	2.01	1	7	653

Notes. To control for response quality, we included a quality check to sort out bots and otherwise non-sensical and / or random data.

Participants were asked to answer an attention check question by choosing one specific answer option at the beginning of the survey (e.g., “To monitor the quality, please press three on the following scale.”). Participants who failed one and more quality checks were sorted out. Also, participants who finished the survey in an unreasonably short amount of time (>180 seconds) were sorted out. In total 49 participants were removed due to failed attention checks or other quality measures of the survey (USA: 22; UK: 27).

Study 1**S-Hypothesis 1:** Hypotheses Study 1¹³

As main effects (H1 & H2) we posit:

H1: Experimentally induced climate change threat will result

- (a) ... in higher subjective climate change threat perceptions (vs. control).
- (b) ... in higher subjective intergroup threat perceptions (vs. control).
- (c) ... in higher levels of modern racism (vs. control).

H2: Experimentally induced intergroup threats will result

- (a) ... in higher subjective intergroup threat perceptions (vs. control).
- (b) ... in higher levels of modern racism (vs. control).

As moderation effects (H3 & H4) we posit:

H3: Moderation by SDO

- H3(a): The relationship specified in H1a will be moderated by SDO such that the effects will be buffered for high SDO individuals (vs. low SDO).
- H3(b): The relationship specified in H1b will be moderated by SDO such that the effects will be more pronounced for high SDO individuals (vs. low SDO).

¹³ Please note that we are following the numbering of hypotheses from the original pre-registrations here in the SOM. For the main text, we changed the numbering of the hypotheses for easier access and text-flow.

H3(c): The relationship specified in H1c will be moderated by SDO such that the effects will be more pronounced for high SDO individuals (vs. low SDO).

H3(d): The relationship specified in H2a will be moderated by SDO such that the effects will be more pronounced for high SDO individuals (vs. low SDO).

H3(e): The relationship specified in H2b will be moderated by SDO such that the effects will be more pronounced for high SDO individuals (vs. low SDO).

H4: Moderation by ingroup identification

H4(a): The relationship specified in H1a will be moderated by ingroup identification such that the effects will be pronounced for individuals highly identified with their ingroup (vs. low identification).

H4(b): The relationship specified in H1b will be moderated by ingroup identification such that the effects will be more pronounced for individuals highly identified with their ingroup (vs. low identification).

H4(c): The relationship specified in H1c will be moderated by ingroup identification such that the effects will be more pronounced for individuals highly identified with their ingroup (vs. low identification).

H4(d): The relationship specified in H2a will be moderated by ingroup identification such that the effects will be more pronounced for individuals highly identified with their ingroup (vs. low identification).

H4(e): The relationship specified in H2b will be moderated by ingroup identification such that the effects will be more pronounced for individuals highly identified with their ingroup (vs. low identification).

S3: Exploratory Factor Analyses (EFA)

EFA: Affect (PANAS): Study 1

We conducted Exploratory Factor Analysis (EFA) using the maximum likelihood extraction method and Promax rotation to determine the factor structure of the 20 items assessing positive and negative affect (PANAS). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .94, which is above the recommended value of .6, indicating that individual items shared enough common variance for such an analysis. Bartlett's test of sphericity was significant: $\chi^2(378) = 9501.738, p < .001$. The EFA yielded four factors which explained 66.53% of the variance. Based on these statistical results, we decided to compute four factors anger, fear, guilt, and sadness.

EFA: Climate Change Threat Perceptions: Study 1

We conducted Exploratory Factor Analysis (EFA) using the maximum likelihood extraction method and Promax rotation to determine the factor structure of the 3 items assessing climate change threat perceptions. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .68, which is above the recommended value of .6, indicating that individual items shared enough common variance for such an analysis. Bartlett's test of sphericity was significant: $\chi^2(3) = 1446.382, p < .001$. The EFA yielded one factor which explained 92.23% of the variance (eigenvalue = 2.77). Based on these statistical results, we decided to retain this one factor only and aggregated all items to form on construct representing climate change threat perceptions.

EFA: Intergroup Threat Perceptions: Study 1

We conducted Exploratory Factor Analysis (EFA) using the maximum likelihood extraction method and Promax rotation to determine the factor structure of the 3 items assessing intergroup threat perceptions. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .72, which is above the recommended value of .6, indicating that individual items shared enough common variance for such an analysis. Bartlett's test of sphericity was significant: $\chi^2(3) = 1153.867, p < .001$. The EFA yielded one factor which

explained 84.84% of the variance (eigenvalue = 2.69). Based on these statistical results, we decided to retain this one factor only and aggregated all items to form on construct representing climate change threat perceptions

Table S4: Correlations Between Variables by Condition (Study 1)

Control Condition (n = 122)					
Measures	2.	3.	4.	5.	6.
1. Social dominance orientation	.25	.47***	-.49***	.53***	.55***
2. Ingroup identification		.27**	-.08	.33***	.33***
3. Intergroup threat perceptions			-.21*	.55***	.54***
4. Climate change threat perceptions				-.39***	-.48***
5. Modern racism					.66***
6. Political orientation					—
Climate Change Threat Condition (n = 127)					
Measures	2.	3.	4.	5.	6.
1. Social dominance orientation	.15	.56***	-.54***	.63***	.56***
2. Ingroup identification		.35**	-.04	.29**	.31***
3. Intergroup threat perceptions			-.27**	.68***	.56***
4. Climate change threat perceptions				-.33***	-.50***

5. Modern racism

.60***

6. Political orientation

—

Measures	Intergroup Threat Condition (n = 129)				
	2.	3.	4.	5.	6.
1. Social dominance orientation	.32**	.63***	-.43***	.67***	.50***
2. Ingroup identification		.57**	-.17	.49***	.38***
3. Intergroup threat perceptions			-.24**	.56***	.53***
4. Climate change threat perceptions				-.35***	-.44***
5. Modern racism					.63***
6. Political orientation					—

Note. *p < .05, **p < .01, ***p < .001

S5: Moderation by SDO and ingroup identification

To test our hypotheses on the moderation effects on different levels of subjective threat appraisals (personal, group, global), we performed three regression analyses on our dependent variables using the PROCESS macro (Version 3.3) by Hayes (2018) for a multi-categorical moderation analysis (Model 2). The three experimental conditions represented by two dummy-coded variables for the climate change threat/intergroup threat (vs. control) conditions were entered as predictors along with SDO (centered) and ingroup identification (centered), and the respective two-way interactions. Political orientation was entered as covariate. The indicator-approach

for the multi-categorical independent variable coded into two dummy variables (D1: 0 = Control, 1 = Climate change threat, 0 =

Intergroup threat; D2: 0 = Control, 0 = Climate change threat, 1 = Intergroup threat) was used as well as bootstrapping with 5,000 random re-samples to estimate 95% confidence intervals for the indirect effects.

As shown in Table S 3, SDO had a significant effect in predicting higher intergroup threat perceptions on the personal, group, and global levels, controlling for the effects of ingroup identification and political orientation. In contrast, ingroup identification was a predictor of intergroup threat perceptions on the personal level. For the group level, ingroup identification was only significantly predictive at the $< .06$ level ($b = 3.51$, $t(368) = 1.94$, $p = .053$). No significant effects on the global level of intergroup threat perceptions were indicated for ingroup identification.

In the first moderation, with intergroup threat perceptions at the personal level as the dependent variable, the interaction between SDO and the climate change condition was significant. Simple slopes showed that, when participants read about the consequences of climate change on the USA, higher SDO predicted ($b = 5.55$, $t(368) = 2.81$, $p = .005$) higher intergroup threat perceptions on the personal level (see Fig. S1). Similarly, when participants read about intergroup threats, higher SDO also predicted ($b = 5.03$, $t(368) = 2.35$, $p = .019$) higher intergroup threat perceptions on the personal level. In the second moderation, with intergroup threat perceptions on the group level as dependent variable, the interaction between SDO and the climate change condition was significant. Simple slopes showed that, when participants read about the consequences of climate change on the USA, higher SDO predicted ($b = 6.13$, $t(368) = 2.76$, $p = .006$) higher intergroup threat perceptions on the group level (see Fig. S1). The interaction between the intergroup threat condition and SDO in predicting intergroup threat perceptions on the group level was only significant at the $< .06$ level ($b = 5.06$, $t(368) = 1.90$, $p = .058$). In the third moderation, with intergroup threat perceptions on the global level as dependent variable, the interaction between SDO and the climate change condition was significant. Simple slopes showed that, when participants read about climate

change, higher SDO predicted higher intergroup threat perceptions on the global level ($b = 4.83$, $t(368) = 2.05$, $p = .041$) (see Fig. S1).

No significant interaction with the intergroup threat condition was found.

Table S6: Regression Analyses Predicting Subjective Threat Perceptions Across Levels

	Intergroup Threat Personal-Level				Intergroup Threat Group-Level				Intergroup Threat Global-Level			
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Climate change threat dummy	19.57	2.81	6.96	< .001	21.41	3.24	6.61	< .001	19.99	3.35	5.96	< .001
Intergroup threat dummy	10.35	2.31	4.49	< .001	12.12	2.91	4.17	< .001	11.31	3.07	3.69	< .001
SDO	2.96	1.18	2.51	.013	4.55	1.76	2.58	.010	5.24	1.94	2.69	.007
SDO x Climate change threat	5.54	1.97	2.81	.005	6.13	2.22	2.76	.006	4.83	2.35	2.05	.041
SDO x Intergroup threat	5.03	2.14	2.35	.019	5.06	2.66	1.90	.058	3.98	2.73	1.46	.146
ID	1.92	0.96	2.00	.046	3.51	1.81	1.94	.053	2.39	2.07	1.15	.249
ID x Climate change threat	4.13	2.34	1.77	.078	2.12	2.74	0.77	.439	2.12	3.01	0.70	.483
ID x Intergroup threat	4.81	1.98	2.43	.016	5.52	2.56	2.14	.033	6.67	2.78	2.39	.017
Political orientation	2.42	1.01	2.39	.017	4.57	1.08	4.23	< .001	5.18	1.09	4.76	< .001
Model summaries	$R^2 = .41$, $F(9,368) = 32.31$, $p < .001$				$R^2 = .49$, $F(9,368) = 63.86$, $p < .001$				$R^2 = .48$, $F(9,368) = 65.11$, $p < .001$			

Notes. ID = Ingroup identification; SDO = Social Dominance Orientation. Continuous variables (in-group identification and social dominance orientation) are centered. Significant effects are displayed in bold. The covariate variable (Political Orientation) was allowed to correlate with both moderators and the outcome variables. Only main effects and significant two-way interactions were included.

However, the analyses were also conducted with all three-way interactions. These interactions were not significant, and model-change

statistics indicate that the addition of these interaction terms did not improve the predictive ability of the models. These higher-order interactions are not discussed in this manuscript.

In regard to ingroup identification as moderator, in the first moderation, with intergroup threat perceptions at the personal level as the dependent variable, the interaction between ingroup identification and the intergroup threat condition was significant. Simple slopes showed that, when participants read about intergroup threats, higher ingroup identification predicted ($b = 4.81$, $t(368) = 2.43$, $p = .016$) higher intergroup threat perceptions at the personal level (see Fig. S1). The interaction between the climate change threat condition and ingroup identification in predicting intergroup threat perceptions on the personal level was only significant at the $< .08$ level ($b = 4.13$, $t(368) = 1.77$, $p = .078$). In the second moderation, with intergroup threat perceptions on the group level as dependent variable, the interaction between ingroup identification and the intergroup threat condition was significant. Simple slopes showed that, when participants read about intergroup threats, higher ingroup identification predicted ($b = 5.52$, $t(368) = 2.14$, $p = .033$) higher intergroup threat perceptions at the group level (see Fig. S1). No significant interaction with the climate change threat condition was found for the group level of intergroup threat perceptions. In the third moderation, with intergroup threat perceptions on the global level as dependent variable, the interaction between ingroup identification and the intergroup threat condition was significant. Simple slopes showed that, when participants read about intergroup threats, higher ingroup identification predicted ($b = 6.67$, $t(368) = 2.39$, $p = .017$) higher intergroup threat perceptions at the global level (see Fig. S1). No significant interaction with the climate change threat condition was found for the global level of intergroup threat perceptions.

Figure S1. Simple slopes for interactions between Social Dominance Orientation (upper row), ingroup identification (lower row) and the experimental conditions (Study 1) across the personal, group, and global levels of intergroup threat perceptions. Ribbons represent 95% confidence intervals. SDO and ID are scored on SD units.

Study 2

S-Hypothesis 2: Hypotheses Study 2

As main effects (H5 & H6) we posit:

H5: Experimentally induced climate change threats will result:

- (a) ... in higher ingroup identification (vs. control group).
- (b) ... in higher collective action support for climate change mitigation policy support via signing online petitions (vs. control group).
- (c) ... in higher subjective intergroup threat perceptions (vs. control group).

H6: Experimentally induced intergroup threats will result:

- (a) ... in higher ingroup identification (vs. control group).
- (b) ... in higher subjective climate change threat perceptions (vs. control group).

As moderation effects (H7 & H8) we posit:

H7: Moderation by SDO:

H7(a): The relationship specified in H5b will be moderated by SDO such that the effects will be buffered for high SDO individuals (vs. low SDO).

H8: Moderation by ingroup identification:

H8(a): The relationship specified in H5b will be moderated by ingroup identification such that the effects will be more pronounced for individuals highly identified with their ingroup (vs. low identification).

H8(b): The relationship specified in H5c will be moderated by ingroup identification such that the effects on intergroup threat perceptions on the group-level will be more pronounced for individuals highly identified with their ingroup (vs. low identification).

H8(c): The relationship specified in H6b will be moderated by ingroup identification such that the effects will be more pronounced for individuals highly identified with their ingroup (vs. low identification).

H9: We expect that the moderation effects posited in the hypotheses above will hold significant, controlling for the effects of political orientation (covariate).

S7: Exploratory Factor Analyses (EFA)

EFA: Emotions (PANAS): Study 2

We conducted Exploratory Factor Analysis (EFA) using the maximum likelihood extraction method and Promax rotation to determine the factor structure of the 14 items assessing positive and negative affect (PANAS). The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .93, which is above the recommended value of .6, indicating that individual items shared enough common variance for such an analysis. Bartlett's test of sphericity was significant: $\chi^2(91) = 10081.313$, $p < .001$. The EFA yielded four factors which explained 79.30% of the variance. Based on these statistical results, we decided to compute four factors anger, fear, guilt, and sadness.

EFA: Climate Change Threat Perceptions: Study 2

We conducted Exploratory Factor Analysis (EFA) using the maximum likelihood extraction method and Promax rotation to determine the factor structure of the 3 items assessing climate change threat perceptions. The Kaiser-Meyer-Olkin (KMO) measure of

sampling adequacy was .69, which is above the recommended value of .6, indicating that individual items shared enough common variance for such an analysis. Bartlett's test of sphericity was significant: $\chi^2(3) = 2159.964$, $p < .001$. The EFA yielded one factor which explained 90.36% of the variance (eigenvalue = 2.71). Based on these statistical results, we decided to retain this one factor only and aggregated all items to form on construct representing climate change threat perceptions.

EFA: Intergroup Threat Perceptions: Study 2

We conducted Exploratory Factor Analysis (EFA) using the maximum likelihood extraction method and Promax rotation to determine the factor structure of the 3 items assessing intergroup threat perceptions. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was .73, which is above the recommended value of .6, indicating that individual items shared enough common variance for such an analysis. Bartlett's test of sphericity was significant: $\chi^2(3) = 1830.651$, $p < .001$. The EFA yielded one factor which explained 88.87% of the variance (eigenvalue = 2.67). Based on these statistical results, we decided to retain this one factor only and aggregated all items to form on construct representing climate change threat perceptions

Table S8: Correlations Between Variables by Condition (Study 2)

Control Condition (n = 212)						
Measures	2.	3.	4.	5.	6.	7.
1. Social dominance orientation	.10	.48***	-.47***	.50***	-.31***	.51***
2. Ingroup identification		.27***	-.22**	.32***	-.10	.40***
3. Intergroup threat perceptions			-.25**	.78***	-.19**	.51***
4. Climate change threat perceptions				-.40***	.29***	-.48***
5. Modern racism					-.22**	.57***
6. Signing online petitions						-.37***
7. Political orientation						—
Climate Change Threat Condition (n = 218)						
Measures	2.	3.	4.	5.	6.	7.
1. Social dominance orientation	.24***	.57***	-.52***	.64***	-.31***	.59***
2. Ingroup identification		.42***	-.09	.38***	-.13	.42***
3. Intergroup threat perceptions			-.20**	.82***	-.25***	.52***
4. Climate change threat perceptions				-.34***	.31***	-.54***
5. Modern racism					-.30***	.61***
6. Signing online petitions						-.36***
7. Political orientation						—

Intergroup Threat Condition (n = 223)						
Measures	2.	3.	4.	5.	6.	7.
1. Social dominance orientation	.29***	.58***	-.40***	.61***	-.24***	.49***
2. Ingroup identification		.48***	-.11	.43***	-.14*	.38***
3. Intergroup threat perceptions			-.13*	.86***	-.12	.48
4. Climate change threat perceptions				-.30***	.19**	-.41***
5. Modern racism					-.12	.55***
6. Signing online petitions						-.28***
7. Political orientation						—

Note. *p < .05, **p < .01, ***p < .001

S9: Moderation by SDO and ingroup identification

As in Study 1, we tested our hypotheses on the moderation effects on different levels of subjective threat appraisals (personal, group, global): To this end, we performed three regression analyses on our dependent variables using the PROCESS macro (Version 3.3) by Hayes (2018) for a multi-categorical moderation analysis (Model 2). The three experimental conditions represented by two dummy-coded variables for the climate change threat/intergroup threat (vs. control) conditions were entered as predictors along with SDO (centered) and ingroup identification (centered), and the respective two-way interactions. Political orientation was entered as covariate. The indicator-approach for the multi-categorical independent variable coded into two dummy variables (D1: 0 = Control, 1 = Climate change threat, 0 = Intergroup threat; D2: 0 = Control, 0 = Climate change threat, 1 = Intergroup threat) was used as well as

bootstrapping with 5,000 random re-samples to estimate 95% confidence intervals for the indirect effects.

Table S10: Regression Analyses Predicting Subjective Threat Perceptions Across Levels (Study 2)

	Intergroup Threat Personal-Level				Intergroup Threat Group-Level				Intergroup Threat Global-Level			
	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i>t</i>	<i>p</i>
Climate change threat dummy	13.86	2.09	6.61	< .001	15.17	2.45	6.19	< .001	13.45	2.49	5.38	< .001
Intergroup threat dummy	11.59	1.96	5.90	< .001	13.72	2.32	5.90	< .001	13.24	2.38	5.56	< .001
SDO	3.98	1.05	3.77	< .001	6.33	1.49	4.25	< .001	6.12	1.52	4.03	< .001
SDO x Climate change threat	4.15	1.62	2.57	.010	4.01	1.90	2.11	.035	3.44	1.95	1.77	.077
SDO x Intergroup threat	4.88	1.75	2.79	.005	3.44	2.09	1.65	.099	3.22	2.14	1.50	.133
ID	2.19	0.88	2.49	.013	2.78	1.37	2.03	.043	1.61	1.40	1.15	.251
ID x Climate change threat	3.67	1.63	2.26	.024	3.27	2.02	1.62	.105	3.48	2.10	1.65	.099
ID x Intergroup threat	3.28	1.53	2.15	.032	4.57	1.87	2.45	.015	5.11	1.87	2.72	.007
Political orientation	1.82	0.65	2.82	.005	2.95	0.72	4.10	< .001	3.61	0.72	4.99	< .001
Model summaries	$R^2 = .37, F(9,643) = 43.65, p < .001$				$R^2 = .43, F(9,643) = 72.57, p < .001$				$R^2 = .41, F(9,643) = 72.29, p < .001$			

Notes. ID = Ingroup identification; SDO = Social Dominance Orientation. Continuous variables (in-group identification and social dominance orientation) are centered. Significant effects are displayed in bold. The covariate variable (Political Orientation) was allowed to correlate with both moderators and the outcome variables. Only main effects and significant two-way interactions were included. However, the analyses were also conducted with all three-way interactions. These interactions were not significant, and model-change statistics indicate that the addition of these interaction terms did not improve the predictive ability of the models. These higher-order

As shown in Table S10, SDO had a significant effect in predicting higher intergroup threat perceptions on the personal, group, and global levels, controlling for the effects of ingroup identification and political orientation. In contrast, ingroup identification was a predictor of intergroup threat perceptions on the personal and group levels. For the global level, ingroup identification was not significant.

In the first moderation, with intergroup threat perceptions at the personal level as the dependent variable, the interaction between SDO and the climate change condition was significant. Simple slopes showed that, when participants read about the consequences of climate change on the UK, higher SDO predicted ($b = 4.15$, $t(643) = 2.57$, $p = .010$) higher intergroup threat perceptions on the personal level (see Fig. S2). Similarly, when participants read about intergroup threats, higher SDO also predicted ($b = 4.88$, $t(643) = 2.79$, $p = .005$) higher intergroup threat perceptions on the personal level. In the second moderation, with intergroup threat perceptions on the group level as dependent variable, the interaction between SDO and the climate change condition was significant. Simple slopes showed that, when participants read about the consequences of climate change on the UK, higher SDO predicted ($b = 4.01$, $t(643) = 2.11$, $p = .035$) higher intergroup threat perceptions on the group level (see Fig. S2). In the second moderation, with intergroup threat perceptions on the group as dependent variable, the interaction between SDO and the intergroup threat condition was not significant. No significant interaction with the intergroup threat or the climate change threat conditions was found for the global level.

In regard to ingroup identification as moderator, in the first moderation, with intergroup threat perceptions at the personal level as the dependent variable, the interaction between ingroup identification and the intergroup threat condition was significant. Simple slopes showed that, when participants read about intergroup threats, higher ingroup identification predicted ($b = 3.28$, $t(643) = 2.15$, $p = .032$)

higher intergroup threat perceptions at the personal level (see Fig. S2). The interaction between the climate change threat condition and ingroup identification in predicting intergroup threat perceptions on the personal level was also significant. Simple slopes showed that, when participants read about climate change threats, higher ingroup identification predicted ($b = 3.67$, $t(643) = 2.26$, $p = .024$) higher intergroup threat perceptions at the personal level (see Fig. S2). In the second moderation, with intergroup threat perceptions on the group level as dependent variable, the interaction between ingroup identification and the intergroup threat condition was significant. Simple slopes showed that, when participants read about intergroup threats, higher ingroup identification predicted ($b = 4.57$, $t(643) = 2.45$, $p = .015$) higher intergroup threat perceptions at the group level (see Fig. S2).

Figure S2. Simple slopes for interactions between Social Dominance Orientation (upper row), ingroup identification (lower row) and the experimental conditions (Study 1) across the personal, group, and global levels of intergroup threat perceptions. Ribbons represent 95% confidence intervals. SDO and ID are scored on SD units.

In the third moderation, with intergroup threat perceptions on the global level as dependent variable, the interaction between ingroup identification and the intergroup threat condition was significant. Simple slopes showed that, when participants read about intergroup threats, higher ingroup identification predicted ($b = 5.11$, $t(643) = 2.72$, $p = .007$) higher intergroup threat perceptions at the global level (see Fig. S2). No significant interaction with the climate change threat condition was found for the group or global levels of intergroup threat perceptions was found.