Am I responsible? The joint effect of individual responsibility attributions and descriptive normative climate messages on climate mitigation intentions

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1. Introduction

While media coverage of climate change has steadily increased since 1990 (Schmidt et al., 2013), several scholars doubt whether the current framing of climate messages is suitable to increase individual climate mitigation behavior (e.g. Brüggemann et al., 2018; Nisbet, 2012). Across different nations, a "masterframe" of anthropogenic climate change can be observed (Brüggemann et al., 2018, p. 244), highlighting climate change as a serious problem caused by human CO_2-emissions (Ivanova, 2017; Schäfer, 2016). At the same time, a content analysis shows that in several countries (e.g. in Germany or the UK) potential measures and solutions are addressed to a lesser extent and are mostly linked to political actions but rarely to individual solutions (Ivanova, 2017; Schäfer, 2016). Put in terms of responsibility attributions (Iyengar, 1991, 1996), we can conclude that *causal responsibility* (who is responsible for causing a problem) is clearly attributed to individual human behavior, while *treatment responsibility* (that has the ability to alleviate the effects of the problem) is attributed to policy. Supporting this observation, an EU survey shows people mainly see societal actors (e.g. 55% national governments, 49% the EU) as being responsible for combatting climate change, whereas only 36% agree that they are personally responsible (Kantar, 2019). Such a lower priority accorded to individual responsibility, however, may be counterproductive for individual climate mitigation behavior, since feelings of personal responsibility for climate action are regarded as "key psychological bridge between … climate-related beliefs and several types of engagement" (Bateman & O'Connor, 2016, p. 207). Although rarely present in media portrayals, emphasizing individual treatment responsibility may be a promising strategy to increase individual feelings of obligation to take responsibility for climate mitigation. Thus, this research first aims to investigate the effects of media messages attributing treatment responsibility for climate mitigation measures to individuals compared to societal actors or no responsibility attributions.

However, empirical evidence shows that causal responsibility attributions may cause boomerang effects (Jang, 2013). Given its characterization as a "collective-risk social dilemma" (Milinski et al., 2008) treatment responsibility messages are particularly at risk to unintentionally cause a diffusion of responsibility. In this dilemma, each individual is called upon to personally invest in climate mitigation in order to reach the common goal, but without knowing whether others will also participate. As a consequence, a diffusion of responsibility to others may take place as an "easy opt-out tendency" (Booth, 2012, p. 409; see also Frantz & Mayer, 2009) and cause a bystander effect (Booth, 2012). This psychological effect describes the phenomenon that the likelihood of

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helping behavior decreases with higher numbers of passive bystanders (Darley & Latané, 1968). Climate mitigation action is at high risk for a bystander effect given the shared character of responsibility across various actors on national and international levels (Booth, 2012). In order to avoid such a bystander effect and instead foster perceptions of individual treatment responsibility, climate messages addressing social norms may be useful. The bystander-effect is strongly linked to assumed social influences (Latané & Nida, 1981). While passivity of various bystanders may increase inaction, there is also a positive bystander effect (Fischer et al., 2011). In high-danger emergencies, where collective action is needed, people's participation may be motivated by the actions of others (Fischer et al., 2011). In line with that, research still shows that individuals are more likely to act pro-environmentally if a relevant number of others act in an environmentally friendly way (Fornara et al., 2011). Accordingly, a Swiss study using focus groups (Stoll-Kleemann et al., 2001) as well as studies with a game theory frame conclude that drawing attention to how others act may be a relevant strategy to avoid diffusion of personal responsibility for climate mitigation and to increase individual treatment responsibility (Milinski et al., 2006; see also; Parks et al., 2001). Therefore, our second aim is to investigate the interplay of individual responsibility attributions in media messages with descriptive normative messages that provide insight into how others engage in climate mitigation behavior in terms of mobility and consumption behavior. This is in accordance with the recommendation by Markowitz and Shariff (2012, p. 243) "to generate strong moral intuitions" in climate communication. In contrast to earlier studies that mostly used summary information to inform about the behavior of others (Tankard & Paluck, 2016; Yamin et al., 2019), we investigated the potential of user comments to make descriptive norms salient by individual behavior cues.

2. Responsibility attributions and climate mitigation behavior

In social psychology, responsibility attributions are typically classified into causal and treatment responsibility (Brickman et al., 1982; Iyengar, 1990, 1996; Yang et al., 2015). While causal responsibility attributions are described as backwards-oriented by asking who is responsible for causing a problem, treatment responsibility attributions are "essentially future-oriented and problem-solving in nature, that is, questions of treatment responsibility seek to establish what can be done to prevent recurrence of the outcome" (Iyengar, 1990, p. 23).

2.1. Perceived treatment responsibility and climate mitigation behavior

Perceived responsibility is included in various pro-environmental behavioral models, such as the norm activation model (NAM) (Schwartz, 1977), the value belief norm theory (VBN) (Stern, 2000; Stern et al., 1999) or integrated approaches (e.g. Abrahamse et al., 2009; Klöckner, 2013). These models mainly conceptualize the ascription of responsibility as causal responsibility by reflecting a "feeling [of] responsibility for the negative consequences of not acting pro-environmentally" (Steg & Nordlund, 2013, p. 189). Only a few studies measured treatment responsibility. In a study about diesel-driven emissions, feeling responsible to take action increased the feeling of moral obligations and intentions to act (Steg & de Groot, 2010). In a similar vein, feeling responsible to solve environmental problems and work together with environmental actors directly increased environmentally friendly behavior of public servants in Taiwan (Fang et al., 2019). In contrast to these studies which deal exclusively with individual responsibility perceptions, a survey of Australian teenagers investigated treatment responsibility perceptions for different actors. While perceived responsibility of the community is positively related to individual pro-environmental intentions, perceived treatment responsibility of the government reduced individual pro-environmental intentions and behavior (Fielding & Head, 2012). In sum, there is some evidence to show that treatment responsibility perceptions can motivate climate friendly intentions or behavior; however, less is known about the way in which *media messages* can stimulate such feelings of responsibility.

2.2. Responsibility attributions in media messages

Research on responsibility attributions in media messages was conducted in political communication, beginning with the seminal work by Iyengar on responsibility frames concerning poverty (Iyengar, 1990, 1996). In environmental communication, a handful of studies investigated the effects of causal responsibility attributions and arrived at heterogeneous results. In two experimental studies, Ferguson and Branscombe (2010) varied the attribution of responsibility for the cause of climate change. In contrast to a natural causal frame that depicted climate change as a naturally occurring phenomenon, a human causal frame that emphasized human action as cause of climate change increased respondents' willingness to engage in climate change mitigation action when future consequences were described as less serious. Causal responsibility attributions in combination with more serious outcomes are assumed to increase the perception of unfeasibility and thus be counterproductive for motivating climate mitigation behavior (Ferguson & Branscombe, 2010; see also; Krosnick et al., 2006; Rickard, 2013). This may be particularly relevant when causal responsibility is attributed to in-groups versus out-groups (Jang, 2013). In an experimental study, information about extensive energy use by US Americans (the in-group of the sample) and its consequences for global warming lowered US-American participants' beliefs in a human cause for climate change and increased beliefs in a natural cause. Indirectly, reduced perceptions of human responsibility also lowered support for climate change policy. This defensive reaction was not apparent when responsibility was attributed to Chinese people (the out-group of the sample) instead of Americans (Jang, 2013). Thus, defensive reactions may be particularly relevant when responsibility is attributed to people themselves or their in-group.

Regarding treatment responsibility, an experimental study by Rickard et al. (2014) varied the attribution of treatment responsibility in a newspaper article to individuals versus to the government (societal responsibility). Individual treatment responsibility attributions in contrast to societal responsibility attributions were positively associated with systematic processing of the message (Rickard et al., 2014). Although this was not measured, the authors argue that systematic message processing is desirable, since it has the potential to positively influence climate change related attitudes and behavior (Rickard et al., 2014).

A second experimental study, which also varied attributions of treatment responsibility to the government versus to individuals (Yang et al., 2015) did not find overall differences regarding support for policies of climate mitigation action or behavioral intentions but again revealed differences in how the message was processed. Here, however, systematic message processing increased pro-environmental behavior intentions only when responsibility was attributed to the government. Given that responsibility perceptions were not measured, it remains an open question whether this effect is due to the higher newsworthiness of the text concerning the government, as the authors speculate, or to variations in perceptions of responsibility.

Based on the existing findings about attributions of causal responsibility, however, we expect that attributions of individual treatment responsibility are more strongly predictive of individual climate mitigation intentions than attributions of responsibility to the government or no responsibility attributions and that this effect is mediated by individual treatment responsibly perceptions.

H1. In contrast to responsibility attributions to the government or no responsibility attributions, individual responsibility are associated with higher intentions for climate friendly mobility behavior.

H2. Attributions of individual treatment responsibility are positively associated with perceptions of individual responsibility, which in turn is positively associated with intentions for climate friendly mobility and

consumption behavior.

3. Social norms and climate mitigation behavior

From a normative perspective, insights into other people's climate protection behavior make descriptive social norms salient. In contrast to injunctive social norms, which reflect what types of behavior relevant others expect in a specific social context, descriptive norms describe how relevant others actually behave in that context (Cialdini et al., 1991). By informing about the most appropriate and adaptive type of behavior, descriptive norms provide "a decisional shortcut when one is choosing how to behave in a given situation" (Cialdini et al., 1991, p. 203). As such, they may be especially useful to motivate climate mitigation behavior of individuals, since they provide information about how relevant others behave and thus may influence how the dilemma is evaluated.

3.1. Descriptive normative climate messages and climate mitigation

While media messages typically refer to descriptive social norms by providing summary information about the social behavior of groups, user comments in the Internet provide individual information about how others think and behave (Geber & Hefner, 2019; Liu & Shi, 2019), and thus provide information about the existing social norms in the group of commenters (Chung, 2018). In general, both individual and summary information cues have the potential to influence social normative perceptions (Tankard & Paluck, 2016; Yamin et al., 2019). However, individual behavior cues do "resemble the typical way in which individuals form their own perceptions based on their subjective experiences" and can thus be assumed to be powerful means to change social norm perceptions (Liu & Shi, 2019, p. 3). This was confirmed empirically in political and health communication research (Chung, 2018; Hsueh et al., 2015, Liu & Shi, 2019). In environmental communication, the potential of user comments to inform about existing descriptive norms on an individual behavior level has not yet been studied. For the most part, studies investigate the effects of normative summary information in a field setting (Farrow et al., 2017; Yamin et al., 2019). Providing descriptive normative information on door hangers, postcards or hotel signs increased participation in recycling (Schultz, 1999), energy conservation behavior (Nolan et al., 2008), water demand management (Fielding et al., 2013) and towel reuse (Goldstein et al., 2008; Reese et al., 2014). However, the normative information used in these studies is directly related to the social situation (e.g. to guests staying in a hotel) (Yamin et al., 2019). In contrast, normative information in mass media messages is timely and spatially more remote to the situation of the reader (Yamin et al., 2019). More closely related to this type of information are marketing studies that include descriptive norms. For example, descriptive norms in advertisements were shown to influence purchasing behavior of smart energy devices (Mingolla et al., 2020) as well as buying intentions regarding over-packaged products (Elgaaied-Gambier et al., 2018).

3.2. Norm strength of descriptive social norms

Psychological research shows that the effects of descriptive norms are sensitive to the level of norm-consistent behavior of other people (Cialdini, 2003; Cialdini et al., 1990; Reno et al., 1993). Especially in situations in which most people are not acting prosocially (Cialdini et al., 1991, 2006) or in ways that suggest conflicting descriptive and injunctive norms (Cialdini, 2003), normative messages may backfire and decrease environmental engagement (Cialdini, 2003; Cialdini et al., 1991, 2006; Schultz et al., 2007). For example, the acceptance of environmental policy measures (de Groot & Schuitema, 2012), intentions to use public transport (Kormos et al., 2014) and water conservation behavior (Mortensen et al., 2017) were more pronounced when messages stated that a majority or a larger number of people already support these pro-environmental measures compared to messages indicating low levels of acceptance. This tendency to behave in line with the majority was the focus of an empirical study that manipulated perceptions of norm strength by informing participants that either 20%, 50% or 80% of the former participants intended to act in an environmentally friendly manner (von Borgstede et al., 1999). The results show that higher levels of normative approval also resulted in increased intentions to behave accordingly (von Borgstede et al., 1999). While weak normative approval may lead to boomerang effects, high levels of normative approval seem to be particularly effective.

Combining existing findings about descriptive norms in user comment sections with the effects of descriptive norm strength in environmental communication, we hypothesize that user comments as individual behavior cues are effective in influencing climate mitigation intentions but only when a majority of the commenters express support for climate action.

H3. Descriptive norms about climate mitigation behavior are positively associated with mitigation intentions for climate friendly mobility and consumption behavior when the majority of commenters act in climate-friendly ways (positive descriptive norm), but are negatively associated with intentions when only a minority of commenters exhibit environmentally friendly behavior (negative descriptive norm) and has no effect on intentions when no clear normative tendency (50%/50%; neutral descriptive norm) is discernible.

Apart from the direct effect, we expect descriptive normative messages to exert an indirect effect on mitigation intentions via individual responsibility perceptions. Nyborg et al. (2006) argue that information about how other people behave (descriptive norm) and thus take responsibility in their daily lives may also increase individual responsibility perceptions (see also Dwyer et al., 2015). In their model, environmentally friendly behavior becomes more likely when people perceive a responsibility to act. Individual responsibility perceptions in turn are expected to be higher, the more people are convinced that environmental-friendly behavior is common. Empirically, such a mediation relationship is shown by Wang and Lin (2017). Based on survey data, a structural equation model shows that the effect of descriptive norms on environmental protection behavior is mediated by responsibility perceptions. Also, survey results from Norway (Brekke et al., 2010) and Sweden (Hage et al., 2009) still show that individual responsibility perceptions for recycling are higher the more people think that recycling is common. Thus, we assume that perceptions of responsibility should be also strengthened when media messages emphasize positive descriptive norms compared to negative or neutral descriptive norms.

H4. Perceived individual responsibility mediates the relationship between descriptive norms in climate messages and climate mitigation intentions for climate friendly mobility and consumption behavior.

3.3. Normative perceptions and pro-environmental behavior

Normative perceptions are already known to be important drivers of individual decision-making, as well as of the formation of environmental intentions and behavior (Kormos et al., 2014; Manning, 2009; Tankard & Paluck, 2016). As such, they are also a key variable used in several behavioral models (e.g. NAM, VBN and the theory of planned behavior [TPB]) to explain environmental action (Steg & Nordlund, 2013). In the NAM and the VBN, normative perceptions are included in the "personal norm," which is defined as the feeling of moral obligation to act in a specific situation (Schwartz, 1977). By representing moral "self--expectations for specific action in particular situations," the personal norm is modeled as the central intervening variable between attitudinal factors and behavior (Schwartz, 1977, p. 127).

In contrast to perceived individual treatment responsibility (the feeling that each single individual and not politicians or other societal actors are responsible to protect the climate), "personal norm" refers to

the individual feeling that persons themselves are morally obliged to act (Schwartz, 1970). While people may accept that individuals are responsible to reduce emissions, e.g. by changing their mobility behavior, they do not necessarily have to feel a moral obligation to personally reduce emissions where possible and despite potential costs.

Reflecting the interrelationship of both variables, theoretical models in the environmental domain (e.g. the VBN) but also more general altruistic behavior models, such as the stepwise helping model (Latané & Darley, 1970) include both constructs.

Even if "personal norm" was originally not included in the TPB, several empirical studies show that the predictive power of the model increases when this feeling of individual moral obligation to act is added (e.g. Gao et al., 2017; Harland et al., 1999; Parker et al., 1995; Rezaei et al., 2019). Theoretically, this additional explanatory power of personal norms may be explained in terms of their relationship to social norms. Social norms are antecedents of a personal norm (Biel & Thøgersen, 2007; Schwartz, 1977). While social norms are learned through social observations as an external source, personal norms represent internalized normative perceptions based on such external cues, but also reflect the individual context (Jansson & Dorrepaal, 2015; Schwartz, 1977). As such, they are the individual moral standard that guides prosocial actions (Schwartz, 1977). Surveys show that perceived personal norms intervene between social norms and intentions or behavior (Doran & Larsen, 2015; Fornara et al., 2016; Hopper & Nielsen, 1991; Rezaei et al., 2019). Adding to this correlational research, we assume that descriptive behavioral cues in climate messages may affect climate mitigation intentions not only directly, but also indirectly by way of perceived personal norms.

H5. Personal norms mediate the relationship between descriptive norms in climate messages and climate mitigation intentions for climate friendly mobility and consumption behavior.

Normative perceptions may be increased not only by descriptive normative information but also by responsibility attributions in media messages. According to Schwartz (1970, p. 284), attributions of responsibility and feelings of moral obligation are interrelated: "Hence increasing the salience of personal responsibility in an appeal is expected to impede the neutralization of moral norms, thereby contributing to the maintenance of a sense of moral obligation." According to this, several empirical studies investigating NAM and VBN (e.g. de Groot & Steg, 2009; Steg et al., 2005) as well as helping behavior of bystanders (Greitemeyer et al., 2006) have shown that perceived responsibility and perceived personal norms are interrelated. Adding to these correlational results, messages that emphasize individual responsibility are also likely to increase the feeling of moral obligation to act.

H6. Personal norms mediate the relationship between responsibility attributions in media messages and climate mitigation intentions for climate friendly mobility and consumption behavior.

4. Study 1

4.1. Method

4.1.1. Participants

136 individuals (84 women, 52 men), with a mean age of 34.22 years, SD = 14.55, ranging from 18 to 73 years, participated in the study. The majority of the participants (78%, $n = 106$) have a higher education degree, 16.2% ($n = 28$), completed secondary education and only one participant has not graduated from school yet (one participant did not indicate his or her level of education). The online questionnaire was distributed by email and through German social network sites, resulting in a convenience sample. In sum, the sample is younger and has a higher level of education than the overall population in Germany, which is typical for a convenience sample recruited online.

A power analysis (using the program G*Power) showed that we needed 116 participants to have a 90% chance of detecting a medium-sized effect ($f^2 = 0.15$) in multiple regression analysis.

4.1.2. Stimulus and procedure

Participants were randomly assigned to one of the three experimental groups (no responsibility attribution $N = 47$, individual responsibility attribution $N = 45$, or societal responsibility attribution $N = 44$). Following a brief introduction, participants provided consent and were asked to read an online-newspaper article and to fill in an online questionnaire. The newspaper article dealt with the relationship between CO_2-emissions caused by planes and the melting of the arctic sea ice. Statements referring to the responsibility for mitigation action were edited according to the experimental group. In the societal responsibility frame, the German government was discussed as a central player in the reduction of CO_2-emissions in the mobility sector, primarily in relation to air travel. Several political measures (e.g. subsidization and expansion of the railway system as a potential substitute for domestic flights; taxation of air traffic) were discussed as tools to reduce CO_2-emissions. In contrast, the individual responsibility frame emphasized the responsibility of each individual to reduce CO_2-emissions by changing mobility behavior (e.g. preferring rail over air travel). The no responsibility frame did not include any responsibility attributions. Rather, it mentioned that measures are necessary, that in particular the mobility sector has the potential to reduce CO_2-emissions and that as much CO_2 as possible must be reduced in order to mitigate climate change, but without making any reference to who is expected to act. At the end of the study participants were debriefed about the experimental manipulation.

4.1.3. Measures

Participants' *perceived individual treatment responsibility* was assessed using three items adapted from the scale by Steg and de Groot (2010). We did not use the formulation "I feel responsible …" of the original scale (Steg & de Groot, 2010), but instead referred to "each single individual" (e.g. "Each single individual is responsible to avoid air travel in order to limit CO_2-emissions.", "Each single individual is responsible to use climate friendly means of transportation."). Participants' responses to the statements were measured using a seven-point Likert scale (1 = "I strongly disagree", 7 = "I strongly agree", $\alpha = 0.76$).

Five statements about *personal norms* relating to mobility behavior were adapted from Doran and Larsen (2015), e.g. "I feel a moral obligation to avoid air travel in future.", "In situation where I cannot avoid using air travel, I feel a moral obligation to compensate for my CO_2-emissions by financially supporting climate mitigation projects.", "I feel morally obliged to pay more for a trip, when it helps to protect the climate." (scale: 1 = "I strongly disagree", 7 = "I strongly agree", $\alpha = 0.78$).

Finally, *intentions for climate mitigation* relating to travel and mobility behavior were also adapted from Doran and Larsen (2015). Five items were included asking participants to indicate the likelihood of using climate-friendly transportation (e.g. "How likely is it that you would … use environmentally friendly means of transportation although this might be more expensive"; 1 = "very unlikely"; 7 = "very likely", $\alpha = 0.75$).

4.1.4. Pretest

In order to test whether the manipulation was successful, a pretest was conducted. 120 voluntary undergraduate participants (113 women, 7 men) with a mean age of 21.12 years ($SD = 1.73$) recruited through university classes assessed one of the three randomly assigned text conditions. Participants were asked to rate the article using a seven-point semantic differential (the text does … "not attribute responsibility for climate mitigation action" – "attributes responsibility for climate mitigation action"). A second semantic differential item was used to check whether the attribution in the political and individual text are evaluated differently (the text attributes responsibility for climate mitigation action to … "the government" – "the individual"). To test

whether the texts are perceived equal in other respects such as appeal and quality, we included five items (e.g. "not interesting – interesting", "informative – not informative", "realistic – unrealistic" and "convincing – not convincing," Peter et al., 2014), again to be assesed on a seven-point semantic differential. Instead of "coherent – incoherent" as the fifth pair in the original items, we used "understandable – not understandable".

An ANOVA was conducted to test whether the experimental manipulation resulted in different evaluations of the stimulus material. As intended, both texts attributing responsibility for climate mitigation to either the government, $M = 4.91$, $SD = 1.54$, or the individual, $M = 4.70$, $SD = 1.33$, were evaluated as clearly attributing responsibility, while the no responsibility frame text was perceived as not attributing responsibility to specific actors, $M = 2.13$, $SD = 1.15$, $F(2, 117) = 51.76$, $p < .001$, $\eta^2_p = .47$. Also in line with our expectations, the individual frame text was rated higher for individual responsibility attributions, $M = 5.49$, $SD = 1.19$, than the societal frame ($M = 2.16$, $SD = 1.03$), $t = 13.45$, $df = 79$, $p < .001$, $r = 0.83$. Regarding the overall evaluation of the text, no significant differences emerged, indicating that the texts did not differ in other characteristics.

4.2. Results

4.2.1. Preliminary analysis

We first inspected bivariate correlations between dependent variables. As expected, treatment responsibility perceptions and the personal norm are both positively correlated with climate mitigation intentions (Table 1).

We also checked for correlations of intentions and sociodemographic variables (age, gender and education). While age and gender are unrelated to intentions, age shows a positive correlation ($r = 0.20$, $p = .02$) and is thus used as a control in the following analysis.

4.2.2. Direct effects of responsibility frame on climate mitigation intentions

In order to test H1, an ANCOVA of the responsibility frame manipulations on intentions for individual climate mitigation was conducted. In contrast to our expectations, no direct effect of different responsibility attributions on intentions to act is discernible, $F(2, 132) = 0.34$, $p = .71$.

4.2.3. Indirect effect of responsibility frame on intentions via personal norm and perceived responsibility

We assumed that the responsibility frame affects intentions for climate mitigation by way of treatment responsibility perceptions (hypothesis 2) and personal norms (hypothesis 6). To test these hypotheses, mediation analysis for multicategorial independent variables using PROCESS 3.4 for SPSS (model 4, effect coding of independent variable, 10,000 bootstrap samples, Hayes, 2018, p. 2) was conducted. While the no-responsibility frame and the societal responsibility frame did not have any indirect effects, the individual responsibility frame indirectly affects intentions through the personal norm. However, in contrast to our assumptions, this indirect effect is negative, $b = -.25$, $SE = 0.10$, 95% CI [−0.45, −0.05]. Contrasted with the conditions without responsibility attribution or societal responsibility attribution, an individual treatment responsibility frame decreased the personal norm, $b = -0.35$, $SE = 0.15$, $t = -2.30$, $p = .02$, 95% CI [−0.65, −0.05]. The personal norm in turn positively predicts intentions for individual climate mitigation, $b = 0.70$, $SE = 0.07$, $t = 9.83$, $p < .001$, 95% CI [0.56, 0.84]. Treatment responsibility perceptions have a marginal positive effect on intentions, $b = 0.14$, $SE = 0.07$, $t = 1.97$, $p = .051$, 95% CI [−0.01, 0.28], but are unaffected by the frame manipulation.

Table 1
Means, standard deviations and intercorrelations for index variables.

Index variables	*M*	*SD*	1	2	3
1. Mitigation intentions	4.26	1.28	–		
2. Perceived treatment responsibility	5.27	1.25	0.56***	–	
3. Personal norm	4.50	1.27	0.77***	0.61***	–

Note: Pearson correlations. $N = 136$, ***$p < .001$, two-tailed.

4.3. Discussion

The individual framing manipulation did not exhibit the expected positive effect on intentions to use climate friendly means of transportation. In contrast to our expectations, an individual responsibility frame decreased the personal norm, which in turn also reduced behavioral intentions. This negative effect of the framing manipulation on personal norms can be explained with empirical results showing a tendency to deny causal responsibility for climate change when one's own in-group is addressed (Jang, 2013). Based on group biases in attribution theory, people tend to deflect harm from themselves and their own group by self-protective attributions (Hewstone, 1990; Weber, 1994). In addition, it seems likely that the topic of the article increased the negative effect: the article dealt with air travel as part of individual mobility behavior, which produces particularly large amounts of CO_2. However, air travel, is a high-cost type of climate mitigation behavior that meets with a relatively strong resistance to change (Tobler et al., 2012). High-cost behaviors are environmental actions that are cost-intensive in a broader sense, including financial costs, but also timely investments or reduced comfort (Diekmann & Preisendörfer, 2003; Tobler et al., 2012). On the one hand, many jobs require travel by plane (Tobler et al., 2012) and, on the other hand, climate change is often left out of account when planning a vacation (Hares et al., 2010).

The high-cost situation may also explain why no direct effect of the different frames but also no indirect effect through responsibility perceptions emerged. On the one hand, flying may be relatively unusual for the participants, so that they generally agree with the problem and the responsibility to reduce air travelling, but do not react differently to the frames since it has no direct implications for their own daily activities. On the other hand, some of the participants may regularly use air plane travelling, but due to their job requirements do not see any possibilities to change this behavior.

Statistically, regarding the relatively high mean of responsibility perceptions a ceiling effect may have also emerged, explaining the missing indirect effect. In terms of the direct effects, our sample size may have also been too small in order to detect small framing-effects in the ANCOVA.

In sum, the results of study 1 reveal the risk of individual responsibility attributions in media messages causing negative boomerang effects (Byrne & Hart, 2009) and the need to test communication conditions that prevent this defensive reaction. In addition, it must be asked whether this negative effect is limited to air travel as a specific type of mobility, or whether it applies also to more low-cost types of mitigation behavior (that are less cost intensive in terms of financial and personal investments), such as climate friendly consumption behavior. Thus, the goal of study 2 is to test the effect of descriptive normative information following individual responsibility messages for daily consumption behavior.

5. Study 2

5.1. Method

5.1.1. Participants

121 participants (74 women, 46 men, 1 missing), with a mean age of 36.14 years, SD = 16.52, ranging from 18 to 69 years, took part in the study. 56.2 percent have a higher education degree. As in study 1, the online questionnaire was distributed by email and through German social network sites.

A power analysis (using the program G*Power) showed that we needed 116 participants to have a 90% chance of detecting a medium-sized effect ($f^2 = 0.15$) in multiple regression analysis.

5.1.2. Stimulus and procedure

Participants were randomly assigned to one of four stimulus conditions varying descriptive norm strength (positive descriptive norm $N = 32$, negative descriptive norm $N = 23$, neutral descriptive norm $N = 33$, control group without descriptive norm $N = 33$).

After giving consent for participation in the study, participants were asked to read a newspaper article about climate mitigation behavior. Similar to the individual responsibility condition in study 1, the article emphasized the need for action by each single person and private households to reduce CO_2-emissions. While study 1 was concerned with mobility behavior, study 2 addresses daily options for a climate friendly consumption behavior as an individual, such as consuming sustainable products, choosing foods with a favorable CO_2-balance, or opting for climate-friendly household electricity. In three experimental conditions, the text was followed by eight user comments manipulating norm strength, while the control condition showed no commentaries. For positive norm strength, a majority of the user comments (6) reported how they realize climate friendly consumption behavior in their daily life (e.g. planting one's own vegetables, buying regional food or buying sustainable clothes in sustainable shops), while two comments reported not engaging for climate protection in their daily live. This relationship was reversed for negative norm strength. For neutral norm strength four positive and four negative commentaries were used. In the control group, only the newspaper article without any user comments was shown. At the end of the questionnaire participants were debriefed about the experimental manipulation.

5.1.3. Measures

To assess *perceptions of treatment responsibility,* three items were adapted from Steg and de Groot (2010) to the reduction of CO_2-emissions. Participants were asked to indicate their level of agreement with each statement ("I feel responsible to reduce CO_2-emissions.", "Each single individual is responsible that Germany addresses its CO_2-emission goals."), on a seven-point Likert-scale (1 = "I strongly disagree," 7 = "I strongly agree" $\alpha = 0.96$).

Similar to study 1, the perceived *personal norm* was measured using three items adapted from Doran and Larsen (2015). The items were related to climate friendly consumption behavior in daily life, ("I feel a moral obligation to behave in climate-friendly ways in my daily life, e.g. by buying regional products.", "I feel morally obliged to pay more for regional and climate friendly products, when it helps to protect the climate.") Again, a seven-point Likert-scale was used (1 = "I strongly disagree," 7 = "I strongly agree" $\alpha = 0.77$).

Participants' *intentions to reduce CO_2-emissions* in daily life were measured by four items adapted form Mancha and Yoder (2015), e.g. "I will try to reduce my carbon footprint in the coming months". Again, a seven-point Likert-scale was used (1 = "I strongly disagree", 7 = "I strongly agree", $\alpha = 0.97$).

Furthermore, three items were used asking participants about their norm perception of the commentaries to check the norm strength manipulation: 1) "The majority of the commenters behave in a climate-friendly manner." 2) "The minority of the commenters behave in a climate-friendly manner." and 3) "Users behaving in climate-friendly and climate-unfriendly ways are balanced." In addition, a seven-point semantic differential with five items was used to test for the *general evaluation of the stimulus text* (see study 1).

5.2. Results

5.2.1. Manipulation check

First, we conducted a treatment check to test whether the manipulation resulted in different evaluations of the comment section. Three univariate analyses of variance with the norm perceptions items as dependent variables and descriptive norm strength as an independent variable were conducted. As expected, participants in the positive norm strength condition agreed more strongly that the majority of the commenters behave in a climate-friendly manner ($M = 5.52$, $SD = 1.75$) compared to the negative norm strength condition ($M = 1.65$, $SD = 1.19$, $p < .001$) and the neutral condition ($M = 2.19$, $SD = 1.32$, $p < .001$), $F(2, 82) = 58.89$, $p < .001$, $\eta^2_p = .59$. Participants in the negative norm strength condition most strongly agreed that only a minority of the commenters behave in a climate-friendly manner ($M = 6.22$, $SD = 1.35$) compared to the positive norm strength condition ($M = 2.32$, $SD = 1.54$, $p < .001$) and the neutral condition ($M = 3.03$, $SD = 1.92$, $p < .001$), $F(2, 82) = 40.33$, $p < .001$, $\eta^2_p = .50$. Additionally, participants the neutral condition perceived the commentaries as significantly more balanced ($M = 5.00$, $SD = 1.70$) than participants in the positive norm strength condition ($M = 2.58$, $SD = 1.77$, $p < .001$) or the negative norm strength condition ($M = 1.87$, $SD = 1.49$, $p < .001$), $F(2, 82) = 26.72$, $p < .001$, $\eta^2_p = .40$.

Regarding general stimulus evaluation, we did not find any differences in perceptions of how informative, realistic, interesting or coherent the text and the comments were. However, the neutral commentary condition was perceived as less convincing ($M = 4.48$, $SD = 1.79$) than the commentaries in the positive norm strength condition ($M = 5.84$, $SD = 1.08$, $p < .001$), the negative norm strength condition ($M = 5.78$, $SD = 0.79$, $p < .001$), and the control condition ($M = 5.70$, $SD = 0.98$, $p < .001$), $F(3, 117) = 8.54$, $p < .001$, $\eta^2_p = .18$. Thus, we controlled for "convincing" in the following analyses.

5.2.2. Preliminary analysis

Again, bivariate correlations between dependent variables were computed. As in study 1, treatment responsibility perceptions and the personal norm are both positively correlated with climate mitigation intentions (Table 2).

5.2.3. Direct effects of norm strength on climate mitigation intentions

In order to test hypothesis 3, we conducted an ANCOVA with norm strength as an independent variable, climate mitigation intentions as a dependent variable and "convincing", age and education as control variables. In line with our assumptions, a significant effect of descriptive norm strength on climate mitigation intentions is discernible, $F(3, 113) = 5.85$, $p = .001$, $\eta^2_p = .14$. The strongest intentions for climate mitigation behavior emerged in the positive norm strength condition ($M = 5.73$, $SD = 1.19$), while intentions were weakest in the negative norm strength condition ($M = 3.62$, $SD = 1.91$). Intentions in the control ($M = 4.88$, $SD = 1.63$) and the neutral norm strength condition ($M = 4.62$, $SD = 1.61$) are in between and do not differ significantly from each other. Pairwise comparisons show that the positive norm strength condition significantly differs from the negative norm strength condition ($p < .001$) but not from the neutral condition or the control condition. In addition, the negative norm strength condition also differs from the control ($p = .006$) and neutral condition ($p = .013$).

5.2.4. Indirect effect of norm strength on intentions via personal norm and perceived responsibility

We assumed that the effect of norm strength on climate mitigation intentions is mediated by individual responsibility perceptions (H4) and personal norms (H5). Again, mediation analysis for multicategorial independent variables using PROCESS 3.4 for SPSS (model 4, effect coding of independent variable, 10,000 bootstrap samples, Hayes, 2018, p. 2)

Table 2
Means, standard deviations and intercorrelations for index variables.

Index variables	*M*	*SD*	1	2	3
1. Mitigation intentions	4.26	1.28	–		
2. Perceived treatment responsibility	5.01	1.63	0.51***	–	
3. Personal norm	4.50	1.27	0.56***	0.41***	–

Note: Pearson correlations. $N = 121$, ***$p < .001$, two-tailed.
In addition, gender ($r = 0.37$, $p < .001$) and education ($r = 0.25$, $p = .007$) are positively correlated with intentions, but age is not.

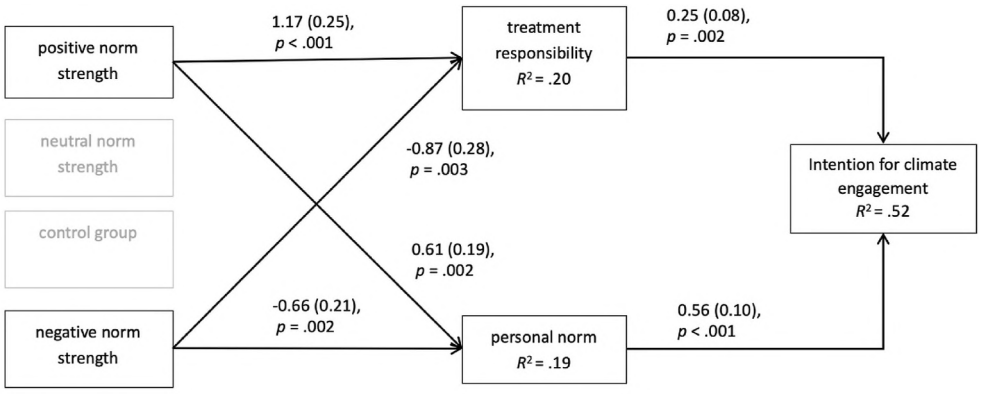


Fig. 1. Mediation model study 2.
Note: Unstandardized regression coefficients and corresponding standard errors are reported. Insignificant paths are omitted in this figure.

was conducted to test these hypotheses. Norm strength was used as an independent variable and mitigation intentions as a dependent variable. "Convincing" was entered as a control variable. As expected, perceived individual responsibility and personal norm both mediated the effect of the positive and the negative norm strength condition on intentions (Fig. 1).

The positive norm strength condition indirectly increased mitigation intentions by way of increasing individual responsibility perceptions, $b = 0.34$, $SE = 0.12$, 95% CI [0.11, 0.59], and personal norm, $b = 0.29$, $SE = 0.11$, 95% CI [0.09, 0.51]. In contrast, the negative norm strength condition indirectly decreased intentions by negatively affecting responsibility perceptions, $b = -0.21$, $SE = 0.11$, 95% CI [−0.46, −0.02], and personal norms, $b = -0.37$, $SE = 0.13$, 95% CI [−0.63, −0.12].

5.3. Discussion

In media messages that emphasize individual responsibility for climate action, user comments showing disengagement with climate friendly consumption behavior in daily life reduced personal norms, and as a consequence also intentions. This effect of negative norm strength in combination with individual responsibility messages is in line with existing literature discussing a denial of responsibility when the disengagement of other people becomes salient (Corral-Verdugo et al., 2002; Jang, 2013) or when a majority of people does not act pro-environmentally (Cialdini et al., 1991, 2006).

In contrast, user comments that show climate friendly consumption behavior in daily life, and thus represent a positive norm strength, are supportive for motivating intentions to reduce CO_2-emissions by increasing personal norm and responsibility perceptions. This result is consistent with studies that have shown positive effects of descriptive normative information in field settings (Goldstein et al., 2008; Nolan et al., 2008; Reese et al., 2014) as well as research investigating normative information in media messages independently of responsibility attributions (Kormos et al., 2014).

In contrast to study 1, no indirect effect via personal norms emerged for the control condition. This may be explained by the constant attribution of individual treatment responsibility and the missing contrast to different types of responsibility attributions.

In addition, also the topic addressed in the text may be an explanation. In contrast to study 1, the text did not focus on air travel – a specific, high-cost type of climate behavior (Tobler et al., 2012). Instead it addressed climate-friendly consumption behavior in daily life, which seems to reduce the risk of negative reactions.

Study 3 aims to replicate the results from study 2 relating to the effect of norm strength in user comments, but investigating the effect in interaction with a variation in individual responsibility attributions.

6. Study 3

6.1. Method

6.1.1. Participants

A quota sample of 308 participants (157 women, 151 men), with a mean age of 38.32 years, $SD = 13.30$, ranging from 18 to 67 years, was recruited to participate in the study. Participants were recruited via personal contact, email and mailing lists by 26 students from a methods class who received course credit. The quota sample aimed for equal distribution of four age groups (18–29, 30–39, 40–49, 50+) and gender. Age and gender are thus equally distributed; however, education was biased: 75.3 percent of the participants have a higher education degree.

A power analysis (using the program G*Power) showed that we needed 171 participants to have a 90% chance of detecting a medium-sized effect ($f^2 = 0.15$) in multiple regression analysis.

6.1.2. Stimulus and procedure

A 2 × 4 online experiment was conducted. All participants were randomly assigned to one of eight stimulus conditions varying individual responsibility attribution in a newspaper article (no individual responsibility attribution versus individual responsibility attribution) and descriptive norm strength in the follow-up commentaries (positive descriptive norm, negative descriptive norm, neutral descriptive norm, control group without descriptive norm). Following a brief introduction, the participants provided consent and, as in study 1, were again asked to read a newspaper article about the relevance of mobility behavior for climate mitigation. In contrast to study 1, the article did not focus exclusively on the climate effect of air travel, but on mobility behavior in

Table 3
Means, standard deviations, and intercorrelations for index variables.

Index variables	*M*	*SD*	1	2	3
1. Mitigation intentions	4.48	1.38	–		
2. Perceived treatment responsibility	4.77	1.49	0.44***	–	
3. Personal norm	4.62	1.58	0.53***	0.53***	–

Note: Pearson correlations. $N = 308$, ***$p < .001$, two-tailed.

general. The text therefore discussed a variety of examples, including car trips in the mountains, plane trips for shopping and sightseeing weekends or the daily commute to work. Similar to the individual responsibility condition in study 1, the text that included individual responsibility attributions emphasized the need for action by each single person to reduce CO_2-emissions, while the text without individual responsibility attributions did not. In six experimental conditions (not the control groups), the text was followed by eight user comments. Similar to study 2, in the positive norm strength, a majority of the user comments (6) reported how they use climate friendly means of transportation in their daily life (e.g. using the train for a trip to the mountains, going to work by bike), while two comments reported not using climate friendly means of transportation. This relationship was reversed for negative norm strength. For neutral norm strength four positive and four negative commentaries were used. At the end of the questionnaire participants were debriefed about the experimental manipulation.

6.1.3. Measures

To assess *perceptions of treatment responsibility* three items used in study 2 were adapted to climate friendly mobility behavior in daily life (e.g. "Each single individual is responsible to use climate friendly means of transportation.", "I feel responsibility to reduce CO_2-emissions."). Participants' agreement with the items was again measured on a seven-point Likert-scale (1 = "I strongly disagree," 7 = "I strongly agree" α = 0.85). In a similar vein, the three items measuring personal norms (Doran & Larsen, 2015) also addressed climate friendly mobility behavior in daily life, e.g. "I feel a moral obligation to behave in climate-friendly ways in my daily life, e.g. by using climate-friendly means of transportation.", "I feel morally obliged to use climate friendly means of transportation even if it's more time consuming". Again, a seven-point Likert-scale was used (1 = "I strongly disagree," 7 = "I strongly agree" α = 0.91). Participants' *intentions to reduce CO_2-emissions* were also measured by five items (Doran & Larsen, 2015) used in study 1 (α = 0.91).

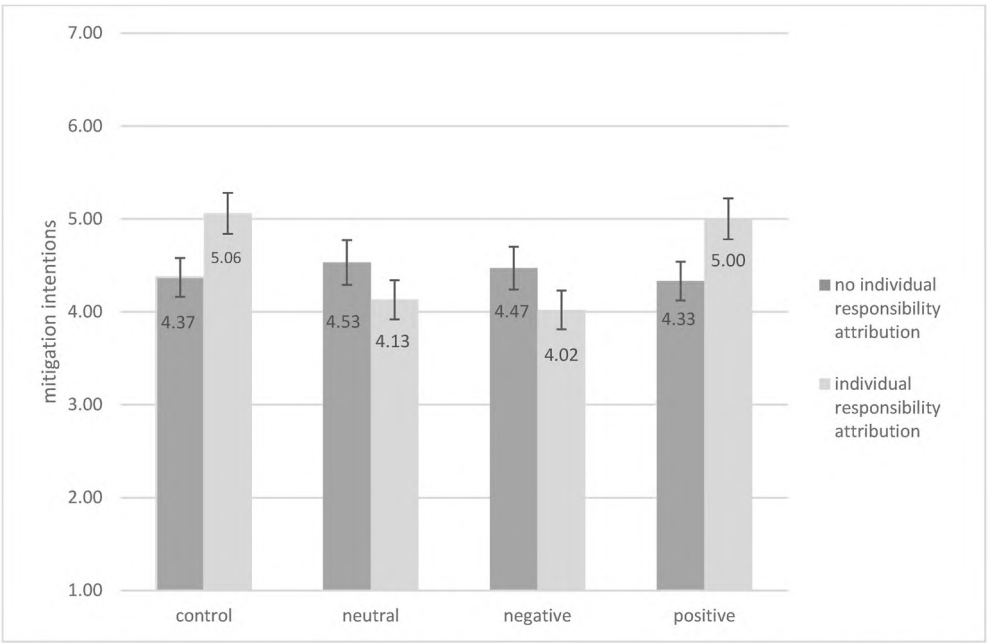
To test the *manipulation of individual responsibility attribution* in the media message, three items on a seven-point Likert-scale (1 = "I strongly disagree", 7 = "I strongly agree" α = 0.89) were used (e.g. "The text emphasizes the responsibility of each single individual for climate protection.").

Items used to test the *manipulation of norm strength* and the *general evaluation of the commentaries* were similar to study 2.

6.2. Results

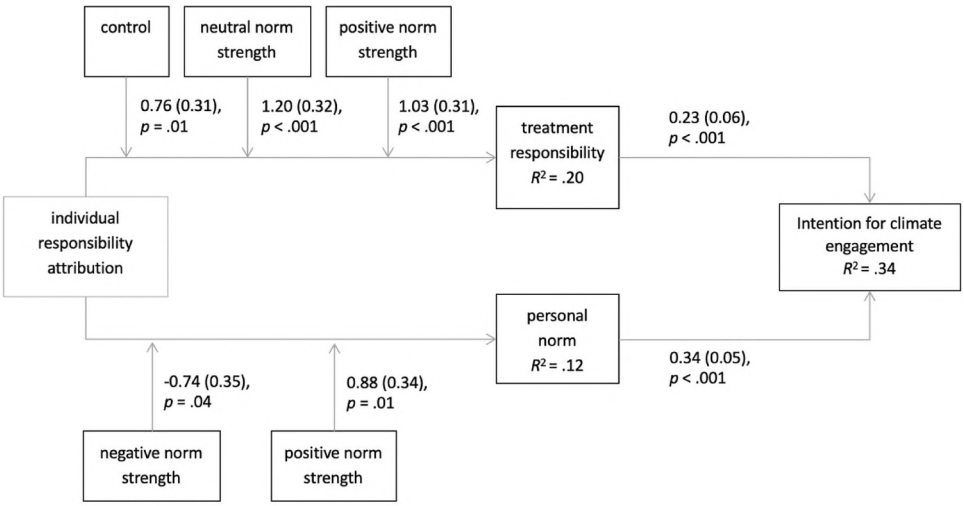
6.2.1. Manipulation check

A *t*-test was conducted to test the manipulation of individual responsibility in the media message. As expected, participants indicated that the media message with individual responsibility attribution emphasized individual responsibility more strongly (M = 5.75, SD = 1.07) than the message without individual responsibility attribution (M = 3.46, SD = 1.75), $t(238.75) = 13.72$, $r = 0.66$. In order to test the manipulation of norm strength, three univariate analyses of variance with norm perception items as dependent variable and descriptive norm strength as independent variable were conducted. Participants in the positive norm strength condition agreed more strongly that the majority of the commenters behave in a climate-friendly manner ($M = 4.71$, SD = 1.71) compared to the negative norm strength condition ($M = 2.70$, SD = 1.48, $p < .001$) and the neutral condition ($M = 3.15$, $SD = 1.18$, $p <$ .001), $F(2, 219) = 38.45$, $p < .001$, $\eta^2_p = .26$. In the same vein, participants in the negative norm strength condition agreed most strongly that only a minority of the commenters behave in a climate-friendly manner ($M = 5.06$, $SD = 1.35$) compared positive norm strength condition (M = 3.13, $SD = 1.79$, $p < .001$) and the neutral condition ($M = 3.78$, SD = 1.41, $p < .001$), $F(2, 219) = 29.91$, $p < .001$, $\eta^2_p = .22$. In addition, the comments in the neutral condition were perceived as most balanced (M



Note. Means and standard errors are reported. No individual responsibility attribution: control N = 41, neutral N = 32, negative N = 34, positive N = 41; individual responsibility attribution control N = 38, neutral N = 43, negative N = 42, positive N = 37.

Fig. 2. Interaction effect of responsibility attribution and norm strength on mitigation intentions
Note. Means and standard errors are reported. No individual responsibility attribution: control $N = 41$, neutral $N = 32$, negative $N = 34$, positive $N = 41$; individual responsibility attribution: control $N = 38$, neutral $N = 43$, negative $N = 42$, positive $N = 37$.



Note: Unstandardized regression coefficients and corresponding standard errors of conditional effects on treatment responsibility and personal norm as well as direct effects of treatment responsibility and personal norm on intentions are reported. Insignificant paths are omitted in this figure.

Fig. 3. Moderated mediation model study 3.
Note: Unstandardized regression coefficients and corresponding standard errors of conditional effects on treatment responsibility and personal norm as well as direct effects of treatment responsibility and personal norm on intentions are reported. Insignificant paths are omitted in this figure.

$= 4.95$, $SD = 1.55$) compared to the positive norm strength condition ($M = 3.35$, $SD = 1.83$, $p < .001$) or the negative norm strength condition ($M = 2.93$, $SD = 1.62$, $p < .001$), $F(2, 219) = 29.59$, $p < .001$, $\eta^2_p = .21$.

Regarding the general stimulus evaluation, five univariate analyses of variance were conducted but did not show any significant differences.

6.2.2. *Preliminary analysis*

Bivariate correlations between dependent variables show positive relationships between all three dependent variables (Table 3).

In addition, a significant correlation of gender and intention ($r = 0.13$, $p = .03$) is visible. Thus, we controlled for gender in the following analysis.

6.2.3. *Direct effects of individual responsibility attributions and norm strength on mitigation intentions*

In order to test H1 and H3, a univariate analysis of variances was conducted, using responsibility attribution of the media message and norm strength of the user comments as the independent and mitigation intentions as the dependent variable. While no main effects of either the responsibility frame or the norm manipulation emerge, a significant interaction effect is discernible, $F(3, 299) = 3.90$, $p = .009$, $\eta^2_p = .04$. In the media message without an individual responsibility attribution, intentions did not vary based on norm strength. However, in the responsibility condition, significant differences between the norm strength conditions emerged in a contrast analysis. Mitigation intentions were significantly higher in the positive norm strength condition (contrast positive – neutral: $p = .004$, contrast positive – negative: $p = .001$) and in the control condition (contrast control – neutral: $p = .002$, contrast control – negative: $p = .001$) compared to the negative norm strength and neutral condition (Fig. 2).

6.2.4. *Indirect effect of norm strength on intentions via personal norm and perceived responsibility*

We assumed that responsibility perceptions and personal norms would mediate the effects of individual responsibility attribution (H2, H6) and norm strength (H4, H5). Given the significant interaction effect of both independent variables on intentions, we were not able to test for singular mediation effects of each independent variable. Instead, we decided to test for H2 and H6 in the conditions of norm strength. Thus, a moderated mediation model (model 8, effect coding of moderator, 10,000 bootstrap samples) using Process for SPSS was conducted (Hayes, 2018, p. 2). Individual responsibility attribution was entered as the independent variable, norm strength as moderator, perceived individual responsibility and personal norm as mediators, gender as a control and mitigation intentions as the dependent variable. Supporting H2, responsibility perceptions mediate the effect of responsibility attribution on intentions in the control condition, $b = .17$, $SE = 0.09$, 95% CI [0.02, 0.36], the neutral condition, $b = 0.27$, $SE = 0.10$, 95% CI [0.10, 0.49] and the positive norm strength condition, $b = 0.23$, $SE = 0.10$, 95% CI [0.07, 0.44]. In all three conditions, individual responsibility attributions in the media message increased individual responsibility perceptions, which in turn positively predicted mitigation intentions (Fig. 3). Only in the negative norm strength condition no significant indirect effect emerged.

For the personal norm, two indirect significant effects emerged confirming H6 (in the positive and negative norm strength condition), while no effects were discernible in the control and neutral condition. In the positive norm strength condition, individual responsibility attributions in the media message positively increased mitigation intentions by way of personal norm, $b = 0.30$, $SE = 0.12$, 95% CI [0.08, 0.56]. Our data shows an opposite effect in the negative norm strength condition, $b = -0.25$, $SE = 0.12$, 95% CI [−0.53, −0.02]. Here individual responsibility attributions in the media message decreased the personal norm, which also reduced mitigation intentions (Fig. 3). In addition, individual responsibility attributions directly reduced intentions in the neutral norm strength condition, $b = -0.59$, $SE = 0.27$, $p = .03$, 95% CI [−1.14, −0.05].

6.3. Discussion

Like in study 1, a negative effect of individual responsibility attributions in climate messages via reduced perceptions of personal norm emerged, but only in the negative norm strength condition. Thus, the results of study 3 support our assumption that the effect of individual responsibility attributions depends on social norms. User comments emphasizing social norms did not influence mitigation intentions as long as the text did not discuss individual responsibility. In line with study 2, emphasizing individual responsibility for climate action in combination with negative norm strength in user comments reduced personal norms, and as a consequence also intentions. Again, a supportive effect of positive norm strength in user comments for individual treatment responsibility messages is visible. User comments showing high engagement for climate mitigation by using climate friendly means of transportation strengthened intentions to reduce CO_2-emission by increasing the feeling of treatment responsibility and personal norm.

However, the supportive effect of media messages emphasizing descriptive norms is limited, since in contrast to study 2 the positive norm strength condition and the control condition do not differ in their direct effect on intentions. The results regarding the control condition may be explained by the topic addressed in the text. Even if daily mobility behavior is not as specific as air travelling used in study 1, it depends more on contextual factors (e.g. place of residence, access to public transport) than daily consumption behavior addressed in study 2.

7. General discussion

Overall, ascribing responsibility to different actors did not influence mitigation intentions. This is consistent with prior research on responsibility attributions and message processing by Yang et al. (2015). However, individual treatment responsibility attributions in media messages reduced mitigation intentions by decreasing the feeling of personal norm. This boomerang effect of individual responsibility attributions corresponds to literature that reports defensive reactions when causal responsibility is attributed to one's own group (Jang, 2013).

Studies 2 and 3 tested the integration of descriptive norms as a communicative strategy for dealing with potential boomerang effects of individual responsibility attributions. In contrast to prior research in environmental communication that integrated descriptive norms using summary information (Farrow et al., 2017), we investigated descriptive normative information in user comments as individual behavioral cues (Liu & Shi, 2019). While normative information in user comments did not influence intentions for climate friendly mobility behavior prompted by media messages without individual responsibility attributions, they influence perceptions and intentions when treatment responsibility is attributed to single individuals (study 3). In contrast to negative norm strength that reduces intentions for climate friendly mobility and consumption behavior, positive norm strength can motivate climate mitigation efforts in this domain. This effect of positive norm strength in user comments is apparent for consumption activities (study 2) but only limited for daily mobility behavior (study 3). This distinct effect of norm strength is in line with prior research showing that intentions for environmental behavior are stronger when people are informed that the majority acts prosocially (de Groot & Schuitema, 2012; Kormos et al., 2014; von Borgstede et al., 1999), as well as with game-theory studies showing the relevance of how others behave in social dilemmas (Milinski et al., 2008).

While our results for the positive and negative norm strength condition were consistent in studies 2 and 3, our results are mixed for the neutral norm strength condition. In contrast to study 3, where the neutral norm strength condition showed similar results to the negative norm strength condition, study 2 revealed an effect of the neutral norm strength condition on intentions that ranged between positive and negative norm strength, similar to the control group. Regarding this ambivalent situation, future research should investigate in more detail which "tipping points" (Ordoñez & Nekmat, 2019) for positive or negative effects of user comments exist.

In addition, our study qualified existing correlational results about the relationship between norms, responsibility and intentions. In particular treatment responsibility perceptions have hardly been investigated yet, but emerged as relevant explaining the effect of descriptive norms as well as treatment responsibility. With regard to the relevance of responsibility perceptions for normative messages, our research adds empirical evidence to the unexpected result reported by de Groot et al. (2013) for injunctive normative messages. Connected with this, we were also able to shed some light on the causal relationship between responsibility attributions and personal norms. While both constructs are highly relevant in environmental behavioral models, prior research has only investigated their correlational relationships (e.g. de Groot & Steg, 2009; Steg et al., 2005). The results of all three experimental studies emphasize the relevance of the personal norm as mediating the effects on intentions of responsibility attributions in media messages.

7.1. Limitations of the present research

A first limitation refers to the manipulation of descriptive norm strength. The news site in the online questionnaire was somewhat artificial, since users were not able to show typical user reactions such as to reply to one of the comments. While experimental studies manipulating norm strength in real online environments are ethically problematic, it would be interesting for future research to investigate the relationship of responsibility attributions and norm strength in online discussions about climate change in (automated) content analyses and to look at its association with user metrics. For example, such an approach was used to investigate the relationship of incivility as a normative process in user comments and its relationship to up- and down-ratings as indicator for injunctive norms (Shmargad et al., 2021).

Regarding the ratio of the user comments used, the ambivalent situation may be somehow unusual. Climate change discussions have been shown to often reflect one dominant opinion, leading to echo chamber in which a spiral of silence becomes likely (Walter et al., 2017). However, research also shows that people who see themselves in a minority situation (Porten-Cheé & Eilders, 2015) or hold strong pre-existing attitudes (Duncan et al., 2020) are more inclined to express their opinion, in particular in oppositional discussions. Thus, it would be particularly interesting for future research to investigate reactions of different audience segments to variations of norm strength in climate discussions.

Although the present studies varied the topics of mitigation behavior across the three studies but not within one sample; thus, results related to topic differences (e.g. high- and low-cost-behavior) need to be interpreted with caution. In order to make more systematic comparisons, future studies would benefit from systematically varying low-cost and high-cost types of climate mitigation behavior.

The samples in all three studies were somewhat biased toward the well-educated segment of the population. While 56%–78% of the participants in our studies have a university entrance qualification, only 33% of the overall German population have this level of education (Autorengruppe Bildungsberichterstattung, 2020). Education was shown to be related to social welfare in general, as well as to pro-environmental behavior in particular (Meyer, 2015). This may also be an explanation why the responsibility measure showed relatively high average scores across all three studies. At the same time higher, however, education in Germany is strongly correlated with higher income and both factors are related to higher levels of personal energy consumption (Kleinhückelkotten et al., 2016). In addition, we did not control for preexisting beliefs in anthropogenic climate change or problem awareness. However, representative studies show that the vast majority of the German population believes that climate change is caused by anthropogenic actions (only 1% doubts that climate change

exists, and 4% do not belief in the anthropogenic cause) and agree that Germany needs to further allocate resources to climate mitigation and adaption measures (Gellrich et al., 2021). We therefore assume that our samples are relatively heterogeneous in their preexisting attitudes regarding anthropogenic climate change. Furthermore, our research is limited to behavioral intentions and does not include actual behavior. Even if a meta-analysis shows a relatively high correlation of intentions and behavior in the environmental domain (Schwenk & Möser, 2009), a substantial part of the variation may still remain unexplained. Longitudinal field studies using experience sampling to investigate people's real-life behavior after exposure to media messages may provide deeper insights into the influence of media messages on real-life decision-making.

7.2. Conclusion

In general, responsibility attributions and social norms seem to be a promising tool for climate change communication. Those responsible for the creation of climate messages might use both elements as motivating factors for low-cost types of mitigation behavior. Although, these appeals must also be used with caution, particularly for messages that focus on high-cost mobility behavior. Emphasizing individual responsibility and positive descriptive norms seems to be only partially effective for this type of behavior and may easily lead to denial or defensive reactions. In addition, whether normative information (in particular summary information) can be used in strategic communication strongly depends on existing normative beliefs in the population. When existing norm strength is in contrast to the communicative goal, normative appeals would not be useful.

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Author statement

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Helena Bilandzic: Conceptualization, Methodology, Writing, Supervision.

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Declaration of competing interest

None.

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