

Effects of Goal Framing and Emotions on Perceived Threat and Willingness to Sacrifice for Climate Change

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Abstract

This study explores discrete emotions (guilt, fear, hope) as mediators for effects of goal framing on perceived threat of climate change and willingness to sacrifice. To reconcile conflicting evidence, the study introduces and tests the distinction between gain-positive frames (positive consequences of engaging in climate protection), gain-negative frames (avoiding negative consequences when engaging in climate protection), and loss frames (negative consequences of *not* engaging in climate protection). Results show that gain-negative frames increase perceived threat and willingness to sacrifice, while loss frames increase them through guilt and fear. Hope is increased by a gain-positive frame but subsequently lowers both outcomes.

Keywords

goal framing, willingness to sacrifice, perceived threat of climate change, climate change communication, emotions

Interventions for climate change mitigation are often guided by public policies at the regional or national scale (Adger, Arnell, & Tompkins, 2005). However, in order to implement political regulations and technical innovations in daily

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life, it is the individual who needs to change behaviors (Steg & Vlek, 2009) even if these implementations are costly and decrease an individual's autonomy. Thus, climate communication is an important means to convey scientific knowledge, public policy implications, and innovative approaches (Moser, 2016). However, climate change communication can be considered as a collective-risk social dilemma:

(i) people have to make decisions repeatedly before the outcome is evident, (ii) investments are lost (i.e., no refunds), (iii) the effective value of the public good (in this case, the prevention of dangerous climate change) is unknown, and (iv) the remaining private good is at stake with a certain probability if the target sum is not collected. (Milinski, Sommerfeld, Krambeck, Reed, & Marotzke, 2008, p. 2291; see also Brown & Stewart, 1999)

This dilemma situation makes climate change communication an intricate issue, because stressing long-term collective losses harbors the danger of backfiring through loss aversion and negative emotions (Gifford & Comeau, 2011; Stoknes, 2014).

Germany is a relevant case to study this paradoxical situation. In the political landscape, Germany is one of the most active countries in the world fostering climate protection (Engels, Huther, Schäfer, & Held, 2013; Schäfer, 2016). However, the effects of global warming are mainly visible in its mountain and alpine regions; the country, nonetheless, has to carry considerable socioeconomic burdens, for example, the obligation to reduce carbon intensity (DARA & Climate Vulnerable Forum, 2012; Schäfer, 2016). While the achievement of political goals requires Germans to be willing to sacrifice financially for climate protection, the personal threat of climate change outcomes is rather low and indirect for most Germans. At the same time, beneficial consequences of climate-friendly actions remain distant and abstract.

Thus, the question arises how climate change outcomes and actions can be effectively framed to evoke emotions that facilitate climate engagement. This study aims to (1) explore how different presentations of climate change consequences affect the perceptions of threat and the willingness to sacrifice for the sake of the environment and (2) test mediating effects of discrete emotions (fear, guilt, and hope).

Framing Actions and Outcomes of Climate Change

In climate communication, framing effects are often regarded as consequences of content-specific or discrete frames that represent compositions of specific facts and arguments (e.g., Nisbet, 2009). In contrast to that, goal

framing as a type of valence framing presents “the same critical information in either a *positive* or a *negative* light” (Levin, Schneider, & Gaeth, 1998, p. 150). Positive goal frames (gain frames) emphasize the positive situation of goal obtainment (e.g., gains when a recommended behavior is performed), while negative goal frames (loss frames) describe the negative situation of goal failure (e.g., losses of not performing that recommended behavior). Even if one frame focuses on action and one on nonaction, the conclusion in both cases is the same (e.g., Rothman & Salovey, 1997). However, there are linguistic degrees of freedom to put the valence of the outcome into words. Gains of an action may be presented as either *obtained positive outcome* or *avoided negative outcome*. Losses of nonaction may be presented as either *avoided positive outcome* or *obtained negative outcome* (Levin et al., 1998; Rothman & Salovey, 1997). Essentially, the difference lies in the positive or negative wording of the *kernel state*, “the basic, root state mentioned in the message’s description of the consequence” (O’Keefe & Jensen, 2009, p. 298). For example, a possible gain frame in climate communication is, “If we reduce carbon dioxide emission, the global temperature will remain stable.” Here, the kernel state—stable temperature—is positive. We refer to this type of frame as a gain-positive frame (see typology in Table 1). Conversely, the same gain frame can be conveyed with a negative kernel state: “If we reduce carbon dioxide emission, the global temperature will not rise.” In this case, the kernel state—the rising temperature—is negative, but it still describes the desired outcome (see also Table 1). We refer to this frame as gain-negative. Typically, a loss frame is expressed by stating that if a behavior is not executed, an undesirable outcome will be suffered (loss-negative frame), for example, “If we do not reduce carbon dioxide emission, the global temperature will rise.” Theoretically, the typology is complemented by a fourth option, the loss-positive frame, which describes that desirable outcomes will *not* be achieved when a behavior is *not* executed, for example, “If we do not reduce carbon dioxide emission, the global temperature will not remain stable.” The behavior is negated (“If we do not reduce . . .”), as is the positive kernel (“. . . not remain stable”). As the double negation makes this particular frame quite unpractical and possibly externally invalid, we will disregard it for our study and test only the remaining three options.

Effects of Goal Framing on Perceptions of Threat About Climate Change Outcomes

Media discourse about climate change typically focuses on damages and losses caused by climate change (Wiest, Raymond, & Clawson, 2015). Positive benefits or gains, such as longer harvesting times, are predominantly

Table 1. Linguistic Variations in Gain and Loss Framing.

		Gain frame: Compliance with recommended behavior	Loss frame: Noncompliance with recommended behavior
Outcome	Positive kernel state	<p><i>Gain-positive: Core message—obtain desirable outcome</i></p> <p>“If we reduce carbon dioxide emission, the global temperature will remain stable.”</p> <p>“If we reduce global warming, the sea level in northern Europe as well as the temperature in southern Europe will remain stable.”</p> <p>“By engaging in climate change mitigation, coastal habitats of many species will be preserved.”</p>	<p><i>Loss-positive^a: Core message—forgo desirable outcome</i></p> <p>“If we do not reduce carbon dioxide emission, the global temperature will not remain stable”</p> <p>“If we do not reduce global warming, the sea level in northern Europe as well as the temperature in southern Europe will not remain stable.”</p> <p>“If we do not engage in climate change mitigation, we will not preserve the coastal habitats of many species.”</p>
	Negative kernel state	<p><i>Gain-negative: Core message—avoid undesirable outcome</i></p> <p>“If we reduce carbon dioxide emission, the global temperature will not rise.”</p> <p>“If we reduce global warming, northern Europe will not be affected by more flooding and southern Europe will not suffer from droughts.”</p> <p>“By engaging in climate change mitigation, coastal habitats of many species will no longer be diminished.”</p>	<p><i>Loss-negative: Core message—suffer undesirable outcome</i></p> <p>“If we do not reduce carbon dioxide emission, the global temperature will rise.”</p> <p>“If we do not reduce global warming, northern Europe will be affected by more flooding and southern Europe will suffer from droughts.”</p> <p>“If we do not engage in climate change mitigation, coastal habitats of many species will be diminished.”</p>

^aThe loss-positive frame was not considered in this study due to double negation.

communicated by climate skeptics (McCright & Dunlap, 2000; Wiest et al., 2015). These gains, however, focus on local or regional benefits, neglecting the overall detrimental consequences of climate change. A more realistic option to stress gains of climate engagement is to point out that climate protection will lead to a maintenance of the status quo (Milinski et al., 2008), which currently represents the best possible outcome. This is a very specific interpretation of gain frame as the maintenance of the status quo does not improve the situation compared to now; at the same time, it does not constitute a threat because the situation is not presented as deteriorating. While gain frames motivate by demonstrating the benefits, they may be less effective in climate change communication because keeping the status quo is a relatively weak prospect compared to actual changes to the positive. There is some evidence that stressing negative outcomes in frames may improve motivations to protect the climate and reduce perceptions of threat. Directly manipulating two types of goal frames, Newman, Howlett, Burton, Kozup, and Tangari (2012) show that for environmental sustainability a loss-negative frame predicts higher intentions for climate-friendly actions than a gain-positive frame.¹ Being confronted with negative outcomes (e.g., floods) also increases concern about climate change consequences (Spence, Poortinga, Butler, & Pidgeon, 2011) and risk perceptions (van der Linden, 2014). Based on this, we assume that frames highlighting the negative outcomes of climate change (gain-negative and loss) increase perceptions of threat by climate change outcomes compared to a frame that highlights the positive outcomes (gain-positive).

Hypothesis 1: Gain-negative and loss frames increase the perceived threat about climate change outcomes compared to a gain-positive frame.

Willingness to Sacrifice in Gain-Loss Scenarios

The basic problem of goal framing in climate change communication is that people have to weigh costs for personal investment against potential collective outcomes (McGraw, Larsen, Kahneman, & Schkade, 2010). People compare (individual) losses of climate-friendly engagement or nonengagement to (collective) losses or (collective) gains (Kahneman & Tversky, 1979; Mccusker & Carnevale, 1995). Additionally, in climate communication there is an imbalance in the magnitude of the outcomes. Positive outcomes of climate-friendly actions that represent a certain probability to sustain the actual status quo are presumed to be relatively weak compared to individual investment, which is a certain loss.

Prospect theory (Kahneman & Tversky, 1979) builds on this consideration with the concept of loss aversion. In a situation in which gains and losses of

the same magnitude are compared, losses are more influential than gains in guiding behavior since people have a stronger inclination to minimize losses than to maximize gains (Kahneman & Tversky, 1979; Novemsky & Kahneman, 2005; Tversky & Kahneman, 1991). This consideration of loss aversion (Brown & Stewart, 1999) is in line with the negativity bias (Meyerowitz & Chaiken, 1987; Spence & Pidgeon, 2010) that also finds evidence for a stronger impact of negative information. In a similar way, fuzzy-trace theory (Reyna, 1989) predicts that saving individual resources outweighs maintaining a status quo in the future (Kühberger & Tanner, 2010). Therefore, highlighting negative consequences of climate change should be more effective for increasing willingness to sacrifice than highlighting potential beneficial outcomes. Fuzzy-trace theory would predict no difference between gain-negative and loss-negative frames (Kühberger & Tanner, 2010). However, we assume that the differences between gain-negative and loss frames are more substantial: While gain-negative frames invoke action (e.g., “If we reduce carbon dioxide emission”), loss frames invoke inaction (e.g., “If we do not reduce carbon dioxide emission”), thus diverting attention away from active engagement. In terms of temporal distance and certainty of gains or losses, this means that gain-negative frames present an action that creates individual costs (losses) now and predicts possible (or uncertain) collective losses later; the loss frame, conversely, presents inaction that is tied to no individual costs at the present. From an individual’s perspective, the certain loss in the present is more palpable than the uncertain loss in the future—which may create the idea that doing nothing may be “worth the gamble” (van der Linden, Maibach, & Leiserowitz, 2015, p. 760). Compared to loss-negative frames, gain-negative frames are more strongly geared to the solution of climate change problems and promote climate-friendly behavior as an effective strategy. In line with this assumption, Spence and Pidgeon (2010) show that a frame containing both negative and positive consequences, compared to a loss-negative frame,² increases positive attitudes toward climate change mitigation as well as perceived severity of climate change impacts (see also Van de Velde, Verbeke, Popp, & Van Huylenbroeck, 2010). In particular, when combined with higher levels of uncertainty, gain-negative frames (labeled as positive frame in the study) increase intentions for climate-friendly behavior compared to a loss frame (labeled as negative frame; Morton, Rabinovich, Marshall, & Bretschneider, 2011, Study 2). Taken together, gain-negative frames seem to be more effective to increase the willingness to sacrifice compared to gain-positive and loss frames. Gain-positive and loss frames are both expected to have the same low effectiveness to motivate cost acceptance. This is supported in a study by Newman et al. (2012) who tested a loss-negative (labeled as negative frame in the study) against a gain-positive frame (labeled as positive

frame in the study) in an environmental advertisement and found no significant main effect of framing for the likelihood of living more sustainably, voting for proenvironmental legislation, and buying sustainable products. Only when concern about climate change outcomes is low, loss frames are slightly more persuasive than gain frames (Newman et al., 2012). We therefore set up the following hypothesis:

Hypothesis 2: A gain-negative frame increases the willingness to sacrifice compared to a gain-positive or loss frame.

Discrete Emotions as Mediators for Goal Framing Effects

Many scholars emphasize that emotions may help create a greater sense of urgency for abstract and distant climate change outcomes (Markowitz & Shariff, 2012; Moser & Dilling, 2004; Roeser, 2012). For considering emotions as a response to goal framed climate messages, Lu (2016) applied an “emotions-as-frames” perspective (Kühne & Schemer, 2015), in combination with gain and loss framing. As an emotional frame, a sadness appeal showing how sea stars are suffering from a disease was pitted against a hope appeal emphasizing how scientists are working on a cure against the disease. The sadness appeal was effective in combination with a gain frame that emphasized consequences for the marine ecosystem when sea stars were saved; the hope appeal, conversely, was more effective when combined with a loss frame that emphasized consequences for the marine ecosystem of losing sea stars (Lu, 2016). However, even without specific emotional appeals (as “emotions-as-frames” do), goal frames evoke emotions. Against the backdrop of the appraisal theory of emotions (for an overview, see Ellsworth & Scherer, 2003; Scherer, 2001), it makes sense to assume that goal frames evoke discrete emotions since they foreground different degrees of situational pleasantness, control of outcomes, and outcome certainty (Feldman & Hart, 2016; Major, 2011). Emotions are regarded as reactions to cognitive reflections of the situation that underlie framing effects (De Martino, Kumaran, Seymour, & Dolan, 2006; Ellsworth & Scherer, 2003). Fear, guilt, and hope are three discrete emotions that have particular relevance for goal framing effects in climate communication as they are characterized by conflicting personal and collective goals inherent in the climate change dilemma (Milinski et al., 2008). All three emerge in goal-incongruent situations, in which the primary goal of a person is threatened but motivational effects are different (Lazarus, 1991).

Fear appeals in climate communication have been linked to effects on attitudes (Meijnders, Midden, & Wilke, 2001). As to goal framing, Spence and

Pidgeon (2010) found that a loss frame, compared to a gain-negative frame, evokes stronger fear responses, which then increases the perceived severity of climate change impacts. On first sight, this finding seems puzzling since both frames emphasize negative outcomes of climate change and thus should equally have the potential to evoke negative emotions (Lecheler, Schuck, & de Vreese, 2013). Two explanations are possible: First, the fear appeal may be weaker for gain-negative frames, because the negative consequences for the climate are *negated*. And, as a meta-analysis of fear appeals by Witte and Allen (2000) shows, perceived severity and susceptibility increase as fear appeals get stronger. Second, in appraisal theories of emotion, fear is experienced when consequences of events are harmful for individual goals and a threat causes immediate harm (Ellsworth & Scherer, 2003; Lazarus, 1991). Loss frames clearly comply with this appraisal by displaying negative outcomes of climate change as a result of failing to engage in action. Based on these theoretical considerations, we assume that fear responses are more pronounced for loss frames compared to the two types of gain frame and that they increase perceptions of threat as well as willingness to sacrifice.

Hypothesis 3: A loss frame increases perceptions of threat and willingness to sacrifice compared to a gain-positive or gain-negative frame through increased feelings of fear.

Apart from fear, Moser (2007) highlights guilt as an emotion that has the potential to motivate climate protection attitudes and behavior. Guilt is evoked when a person behaves inconsistently with norm and value conceptions and believes that the behavior harms other persons or the community (Haidt, 2003; Lazarus, 1991). In contrast to fear, feeling guilty enhances perceptions of social responsibility and prosocial behavior (Moser, 2007; O’Keefe, 2002). Guilt motivates people to confess and to amend behavior in order to avoid further harm to others (Haidt, 2003; O’Keefe, 2002). This moral reasoning makes guilt particularly relevant for situations in which people are requested to help unknown others that are threatened (Lindsey, Yun, & Hill, 2007), as in the case of climate change. As incidental emotion that was primed prior to processing a climate message, guilt increases support for climate change mitigation policies (Lu & Schuldt, 2015). To arouse guilt, the inconsistency between people’s behaviors and their own standards needs to be apparent (O’Keefe, 2002). Both loss and gain-negative frames show negative consequences of climate change; however, only loss frames emphasize the problem of not acting. By pointing out the lack of action, loss frames should be most effective in evoking guilt. We therefore set up the following hypothesis:

Hypothesis 4: A loss frame increases perceived threat of climate change and willingness to sacrifice compared to a gain-positive or gain-negative frame through increased feelings of guilt.

The study by Spence and Pidgeon (2010) also found that when fear is statistically controlled, the effect of the gain frame becomes stronger. Thus, fear suppresses the effect of the gain frame. If a negative emotion suppresses the effect of the gain frame, a positive emotion should enhance it. The broaden-and-build theory (Fredrickson, 1998) suggests that positive emotions, such as contentment or tranquility, tend to broaden an individual's thought-action repertoire, making him or her more open to new information and action options. However, as discussed earlier, climate change cannot be framed in a positive way, since the most positive outcome is a preservation of the status quo. Due to this special characteristic, the positive emotion that seems most relevant for climate change is hope, often discussed as viable alternative to fear (e.g., Myers, Nisbet, Maibach, & Leiserowitz, 2012; Stern, 2012). Hope is not a completely positive emotion, even if its social outcomes are positive, but is based on considerations of negative outcomes (Lazarus, 1991). Lazarus (1991), therefore describes the core relational theme of hope as "fearing the worst but yearning for the better" (p. 282). Compared to a loss frame that focuses on a poor perspective only and thus displays a *hopeless* perspective, both gain frames show a solution to improve negative climate change effects. However, only the gain-positive frame describes the favorable outcome of action in a positive way. We assume that a gain-positive frame (in contrast to a loss and gain-negative frame), which promises a positive outcome as a consequence of action, has the potential to evoke hope. Empirical evidence for the influence of hope on proenvironmental behavior is mixed. Feldman and Hart (2016) found that adding efficacy to messages (in contrast to messages without efficacy) increases hope, which then strengthens intentions for political participation. In accordance with that, hope enforces interest in climate protection and perceived effectiveness of climate messages but not behavioral intentions (Chadwick, 2015). In a direct comparison of a hope and a sadness appeal, Lu (2016) found hope to be relatively less effective in influencing information seeking, policy support intentions for proenvironmental behavior. These diffuse results may be caused by the relatively unspecific action tendency of hope that may be limited to the "yearning for a positive outcome" (Lazarus, 1991, p. 285). Thus, an exclusively positive orientation on future outcomes may lower perceptions of current threats. We therefore hypothesize the following effect:

Hypothesis 5: A gain-positive frame decreases perceived threat through hope compared to a gain-negative or a loss frame.

For willingness to sacrifice, results are less clear and two opposing assumptions are possible: Hope may increase the willingness to sacrifice since hoping for a positive outcome may make financial investment more reasonable. At the same time, hope may reduce the feeling of urgency and severity of threat and thus lower the need for investment. We therefore propose the following research question:

Research Question 1: How is willingness to sacrifice affected by increased feelings of hope in a gain-positive climate frame?

Method

Participants and Procedure

A quota sample of the German general population was used for this study. Earlier studies show that age, gender, and education affect climate engagement, and thus our aim was to keep these basic demographic variables constant in order to allow inferences of our results for a broad part of the population. Recruitment was based on gender (50% male vs. 50% female), age (three equal age-groups: 18-35 years, 36-59 years, 60+ years), and education (with and without a degree for higher education). 247 participants were recruited by 23 trained student interviewers who received course credit for this task. Half of the respondents ($n = 124$) were female, and half ($n = 124$) were male ($n = 2$ with missing gender), with a mean age of 46 years ($SD = 18.40$), ranging from 18 to 86 years. A total of 54% had a degree for higher education, 45% completed secondary education, and less than 1% had not graduated from school. Participants were randomly assigned to one of the three experimental groups (news article with a loss frame, a gain-positive frame, and a gain-negative frame). After reading the text, participants filled out a paper-and-pencil questionnaire.

Stimulus Materials

The stimulus materials consisted of three edited texts from a German online news magazine. For the framing conditions, a text about the 2012 United Nations Climate Change Conference in Doha was used. The text focuses on the consequences of global climate change and the relevance of preventive action with a specific focus on Europe. All three articles were titled “Climate Conference in Doha: New Discussions About the Dimensions of Global Warming” and had about 340 words. Statements covering climate protection actions as well as the valence of consequences (framing manipulation) were

edited. Preventive action was enforced in both gain frames (e.g., “If the international community becomes more active in climate protection . . .”) but negated in the loss frame (e.g., “If the international community does not become more active in climate protection . . .”). Additionally, the gain-positive frame puts forward a positive kernel (“If we act resolutely against climate change, there is a good chance that the sea level will stay constant. The shorelines of small island states will remain the way they are today”). In contrast, consequences in the loss frame were presented with a negative kernel (e.g., “If we do not act resolutely against climate change, the sea level will rise. Small island states will be threatened by shoreline erosion and coastal floating”). The same is true for the gain-negative frame, which was also phrased with a negative kernel (e.g., “If we act resolutely against climate change, the sea level will not rise. Small island states will not be threatened by shoreline erosion and coastal floating”).

Measures

To measure *perceived threat of climate change*, participants were asked to indicate their level of agreement with six statements (7-point scale, 1 = *strongly disagree*, 7 = *strongly agree*) adapted from Taddicken and Neverla (2011). Statements measured the extent to which people believe that climate change outcomes negatively affect their life (e.g., “Climate change affects my own life,” “Climate change affects everyone,” “Climate change causes high costs,” “In the future, climate change will affect humans’ lives significantly,” “Climate change also has a lot of advantages”—reverse coded, “Humans will cope well with the challenges of climate change”—reverse coded). The six items were averaged ($M = 5.55$, $SD = 0.93$, $\alpha = .73$).

Willingness to sacrifice was measured with five items (7-point scale, 1 = *strongly disagree*, 7 = *strongly agree*; one item adapted from Taddicken & Neverla, 2011, and four more added) regarding the potential financial and other costs of various climate-friendly actions (“I am willing to pay more for climate-friendly products,” “I am willing to adhere to the law as well as other climate regulations, even if they restrict my daily life,” “Higher prices for climate-friendly energy are acceptable,” “It is important for me to buy climate-friendly food, even if it is more expensive,” “I am willing to sacrifice some everyday conveniences for climate protection,” Taddicken & Neverla, 2011). The five items were averaged to form a reliable measure for willingness to sacrifice ($M = 4.50$, $SD = 1.43$, $\alpha = .87$).

To assess *discrete emotions*, participants rated how much they experienced each emotion while reading the article on 7-point Likert-type scales (ranging from 1 = *did not feel this way at all* to 7 = *felt very much this way*).

Fear and guilt were each measured with three items (fear: frightened, afraid, scared; guilt: remorseful, guilty, conscience-stricken) from the German Modified Differential Affect Scale (Renaud & Unz, 2006). The three items for fear ($M = 3.04$, $SD = 1.40$, $\alpha = .81$) and guilt ($M = 2.86$, $SD = 1.33$, $\alpha = .82$) were averaged and formed reliable measures. For hope, three items by Richins (1997) were used: “optimistic,” “encouraged,” and “hopeful.” Again, the three items formed a reliable scale ($M = 3.00$, $SD = 1.29$, $\alpha = .76$). Additionally, participants were asked to indicate their age, gender, and level of education.

Results

Manipulation Check and Preliminary Analysis

In a pretest, 166 students assessed the framing manipulation. After reading one of the three articles about climate change, participants were asked to identify gains or losses in the texts. Participants were asked to rate two items, one focused on gains versus losses (“Does the article emphasize the gains of acting for climate protection or the losses of not acting for climate protection?”; scale 1 = “emphasizes gains,” 7 = “emphasizes losses”) and the other focused on benefits versus harms (“Does the article highlight benefits of climate protection actions or harm of not acting for climate protection?”; scale 1 = “emphasizes benefits,” 7 = “emphasizes harm”). Both items showed a substantial positive correlation ($r = .80$, $p < .001$) and were averaged ($M = 4.55$, $SD = 1.85$). An analysis of variance yielded a significant difference between all three frames, $F(2, 165) = 64.33$, $p < .001$. In line with our expectations, the gain-positive frame was perceived to highlight gains and benefits of climate protection actions most strongly ($M = 2.94$, $SD = 1.43$), the loss frame was perceived to focus on harms and negative consequences ($M = 6.21$, $SD = 0.67$), and the gain-negative frame ranged in between ($M = 4.22$, $SD = 1.57$).

The experimental groups did not differ in gender, $\chi^2(2) = 1.45$, $p = .48$, level of education, $\chi^2(2) = .08$, $p = .96$, or age, $F(2, 244) = .91$, $p = .40$.

Tests for Hypotheses and Research Questions

The correlation analysis for the dependent variables shows that perceived threat and willingness to sacrifice are positively correlated with each other, $r = .57$, $p < .001$. Thus, a multivariate analysis of variance was conducted to examine the effects of the independent variables on the combined dependent variables. The results show a multivariate effect of the frame on the dependent

Table 2. Average Mean of Perceived Threat and Willingness to Sacrifice by Frame.

Dependent variable	Frames			F	η^2_{part}
	Gain-positive, M (SD)	Gain-negative, M (SD)	Loss, M (SD)		
Perceived threat	5.36 (1.01) _a	5.74 (0.80) _b	5.54 (0.95) _{a,b}	$F(2, 247) = 3.71, p = .026$.03
Willingness to sacrifice	4.23 (1.40) _a	4.78 (1.39) _b	4.49 (1.46) _{a,b}	$F(2, 247) = 3.23, p = .041$.03

Note. Within each row, means with mismatching subscripts differ at $p < .05$.

variable, $F(2, 247) = 4.48, p = .021, \eta^2_{\text{part}} = .04, \Theta = .04$.³ In order to analyze specific group differences, two univariate analyses for both dependent variables were performed. For perceived threat, pairwise comparisons (Bonferroni adjustments) revealed that readers of a gain-negative frame perceive climate change as more personally threatening than did readers of a gain-positive frame (Table 2). There is no difference between loss and gain-positive or gain-negative frames.

In line with our assumption, the gain-negative frame was also more effective in increasing willingness to sacrifice than the gain-positive frame (Table 2). Loss frames did not show significant differences on willingness to sacrifice, neither in contrast to gain-positive frames nor in contrast to gain-negative frames.

We assumed that hope, fear, and guilt mediate the relationship between framing and perceived threat of climate change as well as willingness to sacrifice (Hypothesis 3-Hypothesis 5, Research Question 1). To test these hypotheses, we conducted mediation analyses for multicategorical independent variables using the PROCESS macro for SPSS (Hayes & Preacher, 2014). Effect coding was used to draw comparisons of each frame with the grand group mean. Bootstrap standard errors and bias-corrected 95% confidence intervals [CIs] are generated based on 10,000 bootstrap samples. Guilt, fear, and hope serve as mediators. The analysis was conducted separately for willingness to sacrifice and perceived threat of climate change.

The gain-negative frame does not affect emotions but directly increases perceived threat of climate change, 95% CI [0.05, 0.35] (Figure 1). The loss frame strengthens fear and guilt but decreases hope. In turn, fear and guilt also increase perceptions of threat, while hope diminishes it. Thus, in line with our assumptions, loss frames enhance perceptions of threat indirectly through fear and guilt (Table 3). Given the diminishing effect of loss frames

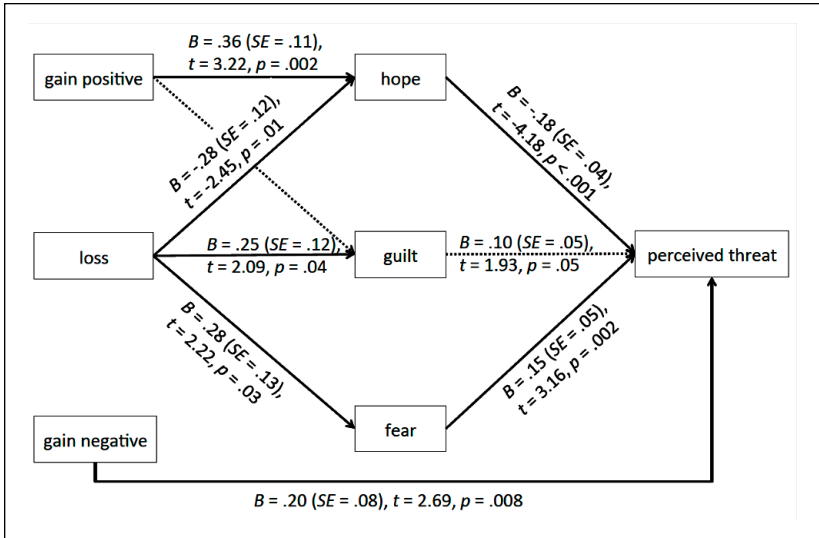


Figure 1. Direct effects of frames and emotions on perceived threat.

Note. For clarity of visualization, only significant paths are presented. Model summary for regression of frames on perceived threat: $R^2 = .18$, $F(5, 244) = 10.90$, $p < .001$. Model summary for regression of frames on hope: $R^2 = .04$, $F(2, 247) = 5.59$, $p = .004$. Model summary for regression of frames on guilt: $R^2 = .02$, $F(2, 247) = 2.52$, $p = .08$. Model summary for regression of frames on fear: $R^2 = .02$, $F(2, 247) = 2.49$, $p = .08$.

on hope, hope only directly decreases perceptions of threat; indirectly there is no negative effect but instead a small positive indirect effect. As expected, a gain-positive frame increases feelings of hope. However, hope decreases threat perceptions. Thus, a negative indirect effect of gain-positive frames on perceptions of threat through hope emerges.

For willingness to sacrifice, indirect effects through guilt, fear, and hope become visible (Table 3). Loss frames indirectly enhance willingness to sacrifice through guilt and fear. The loss frame increases guilt and fear. In turn guilt strengthens the willingness to sacrifice. Additionally, there is a tendency for fear to increase the willingness to sacrifice. In contrast, the loss frame decreases hope, but hope also decreases the willingness to sacrifice. Thus, the negative effect of hope on willingness to sacrifice is diminished by a loss frame.

The gain-positive frame has a negative indirect effect on willingness to sacrifice through hope and guilt. The gain-positive frame reinforces hope, but hope in turn weakens the willingness to sacrifice. The negative effect through guilt is based on an only marginal tendency of the gain-positive frame to reduce guilt, $B = -.21$, $SE = 0.12$, $p = .07$, but guilt in turn raises willingness

Table 3. Indirect Effects of Frames on Perceived Threat via Emotional Mediators.

Dependent variable	Mediator	Gain-positive frame			Gain-negative frame			Loss frame	
		Indirect effect (boot SE)	Boot 95% confidence interval	Indirect effect (boot SE)	Boot 95% confidence interval	Indirect effect (boot SE)	Boot 95% confidence interval		
Perceived threat	Hope	-0.07 (.03)	[-0.13, -0.02]	0.01 (0.02)	[-0.03, 0.06]	0.05 (0.02)	[0.01, 0.10]		
	Fear	-0.03 (0.02)	[-0.08, 0.007]	-0.02 (0.02)	[-0.07, 0.01]	0.04 (0.03)	[0.006, 0.11]		
	Guilt	-0.02 (0.02)	[-0.07, .0000]	-0.004 (0.01)	[-0.04, 0.02]	0.02 (0.02)	[0.0002, 0.08]		
Willingness to sacrifice	Hope	-0.06 (0.03)	[-0.13, -0.02]	0.01 (0.02)	[-0.02, 0.06]	0.05 (0.02)	[0.01, 0.11]		
	Fear	-0.02 (0.02)	[-0.09, 0.005]	-0.02 (0.02)	[-0.08, 0.01]	0.04 (0.03)	[0.002, 0.13]		
	Guilt	-0.07 (0.04)	[-0.17, -0.003]	-0.01 (0.04)	[-0.09, 0.06]	0.08 (0.05)	[0.005, 0.20]		

Note. Values in bold face are significant at $p < .05$.

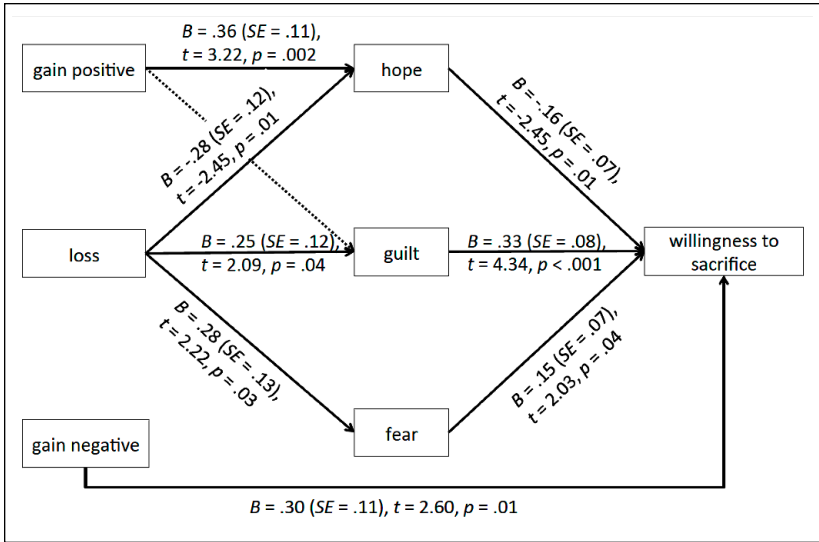


Figure 2. Direct effects of frames and emotions on willingness to sacrifice.

Note. For clarity of visualization, only paths are presented that are relevant for the interpretation of indirect effects. Model summary for regression of frames on willingness to sacrifice: $R^2 = .20$, $F(5, 244) = 12.53$, $p < .001$. Model summary for regression of frames on hope: $R^2 = .04$, $F(2, 247) = 5.59$, $p = .004$. Model summary for regression of frames on guilt: $R^2 = .02$, $F(2, 247) = 2.52$, $p = .08$. Model summary for regression of frames on fear: $R^2 = .02$, $F(2, 247) = 2.49$, $p = .08$.

to sacrifice (Figure 2). Again, the gain-negative frame does not affect emotions, but directly increases willingness to sacrifice, 95% CI = [0.07, 0.52].

Discussion

Framing the action and outcomes in a climate change message is an effective strategy to influence perceived threat of climate change and the willingness to sacrifice. Extending previous research, we distinguished between three types of goal frames: (1) loss frames emphasize negative outcomes of inaction, (2) gain-negative frames focus on the avoidance of negative outcomes of climate-friendly actions, and (3) gain-positive frames feature positive outcomes of climate-friendly actions. While a few framing studies in climate communication already compared two types of goal frames, studies that test three or four of the combined frames are missing. Additionally, empirical studies often implement concepts in a heterogeneous way and label the frames differently (e.g., Lu, 2016; Spence & Pidgeon, 2010), which makes

systematic comparisons difficult. The matrix differentiating frames according to actions and outcomes (Table 1) enables a clear conceptualization of different goal frames that may be useful in future studies.

In an experiment, we confirmed our assumptions that gain-negative frames are particularly effective to increase the willingness to sacrifice and perceptions of threat. This adds to existing research about the effects of discrete climate change frames on severity perceptions (e.g., Gifford & Comeau, 2011; Spence, Leygue, Bedwell, & O'Malley, 2014). While gain-negative and loss frames both show negative outcomes of climate change, only gain-negative frames emphasize possible actions and shows that action will be useful. This resonates with the assumption of the extended parallel process model (Witte, 1992) that threat and efficacy perceptions interact to influence attitudes and behavior. However, while fear mediates the effect of loss frames on perceived threat and willingness to sacrifice, fear is not relevant for the effectiveness of gain-negative frames. One possible explanation may be the dynamic unfolding of emotions during the reception process (Scherer, 2009). While personal threat of climate change in principle has the potential to motivate fear responses, the emphasis on action in gain-negative frames sensitizes the reader to options to take action against the threat and thus reduce fear. This would be in line with danger control responses in the extended parallel process model (Witte & Allen, 2000; Witte, Cameron, McKeon, & Berkowitz, 1996). In order to measure such a dynamic development of fear responses during message processing, continuous measures would be highly informative.

The action focus of a gain-negative frame seems to be especially relevant for Germany, since direct effects of climate change are not as dramatic as in other regions of the world, but the socioeconomic investment to reduce greenhouse gas emission is comparatively high (DARA & Climate Vulnerable Forum, 2012; Schäfer, 2016).

Furthermore, a gain-positive frame is less effective than a gain-negative frame. Climate change in a gain-positive frame is perceived as less threatening and less worthy of financial investment. Gain-negative and loss frames do not differ in their influence on perceived threat or willingness to sacrifice. This is in contrast to the study by Newman et al. (2012). However, Newman et al. used a combined manipulation of goal-framed message and positive or negative pictures. This visualization of consequences may have reinforced the power of the loss-negative over the gain-positive frame consistent with the negativity bias. In order to gain deeper insights into combined effects of goal framing and pictures, future studies should test different forms of visualizations of climate change outcomes and goal frames on emotions.

Indirect effects of the frames through all three emotions were visible. Hope showed the assumed negative effect not only on perceived threat of

climate change but also on willingness to sacrifice. We found a negative indirect effect of hope evoked by a gain-positive frame. While the negative effect of hope on perceptions of threat is consistent with the literature (Lu, 2016), the negative effect on willingness to sacrifice needs to be discussed. One explanation is that feelings of hope that were strongest in a gain-positive frame resulted in an overly positive evaluation of outcomes of climate-friendly action while at the same time threat was perceived as less problematic (Marcus, Neumann, & MacKuen, 2000). This is supported by the results by Chadwick (2015) who shows that hope increases perceptions of the effectiveness of climate engagement. A second explanation builds on the unspecific action orientation of hope (Lazarus, 1991). The description of climate protective actions in the stimulus texts did not discuss any details; this may not have been sufficient to bring up intentions to sacrifice based on hope. Again, this is reflected in Chadwick's (2015) results showing that hope positively affected interest in climate change but not behavioral intentions. Future research should address the conditions necessary to motivate proenvironmental action based on the feeling of hope or other positive emotions.

Negative emotions were conducive for enhancing willingness to sacrifice and perceived threat in a loss frame. Guilt and fear show similar patterns of mediation for a loss frame on perceived threat of climate change. For the effect of loss frames on willingness to sacrifice, only guilt emerged as relevant mediator—while fear showed only a weak, marginal tendency to increase willingness to sacrifice. This weak effect is consistent with the fear appeal literature showing that fear is linked to avoidance behavior and not active engagement—at least when self-efficacy or a specific action tendency is absent (Lecheler et al., 2013, Moser 2007, Witte & Allen, 2000).

While past research focused on fear as mediator of loss frames on threat perceptions (Spence & Pidgeon, 2010), we are able to show that guilt is a second relevant emotion evoked by climate messages and influences threat perceptions. In contrast to fear, guilt also mediates the effect of the loss frame on willingness to sacrifice. This highlights the relevance to examine effects of emotions over and above a focus on emotional valence and to include other discriminating factors such as action tendencies. In contrast to fear, guilt relates individual behavior to others and motivates people to help and act in a socially responsible way (Haidt, 2003), which seems most relevant for a distant and abstract topic such as climate change. This motivational focus of guilt also explains the relatively stronger effect of guilt on willingness to sacrifice in contrast to the relatively weak effect on perceived threat. While we are aware that thresholds may exist for the intensity of guilt and fear, we tentatively conclude that negative emotional reactions to climate change news reports may actually be quite functional in activating willingness to

sacrifice for climate change mitigation in a population that is less affected with climate change outcomes but needs to invest in environmental protection. Future research should address the question whether these negative emotions will cause boomerang effects in specific audience segments based on motivated reasoning (Hart & Nisbet, 2012). A challenge will be to identify target groups and determine the relevant “dose”—how much negative emotion is appropriate for the cautious, doubtful, or concerned (Metag, Füchslin, & Schäfer, 2015).

Practical Implications for Climate Communication

The experimental manipulations focused on a careful wording of the same issue that emphasized either climate-friendly action or nonaction and related consequences of climate change. The overall message of the newspaper article was the same, but specific wording of several sentences changed the emotional reaction toward the message as well perceptions of threat and willingness to sacrifice. This finding is crucial for designing climate messages—it alerts journalists and educators not to disregard the form of the message, which needs as careful attention as the content. While negative wording creates a message similar to a fear appeal, changing the action orientation integrates a motivational perspective that has the potential to positively reinforce climate engagement (Hastings, Stead, & Webb, 2004). However, a too-positive message, such as a gain-positive frame that attenuates potential threats, does not seem to be an effective strategy to increase climate engagement. Due to the abstract and distant nature of climate change outcomes in Germany, motivation to act requires accentuation of the need for individual action, which is directly related to threats.

Limitations

This study has some limitations that should be considered when interpreting the results. First a quota sample was used for the study that creates variance terms of age, gender, and education. However, since it is not a random sample, our results are not representative for the German population. However, we assigned participants randomly to the experimental groups in a controlled between-subjects experiment. Since we were interested in mechanisms of framing effects in climate communication, generalizability is of limited concern (Shapiro, 2002). A second limitation is the use of only one stimulus, which reduces the generalizability of our data. However, the stimulus texts used are edited versions of an original article published in a German online newspaper and thus are externally valid. Third, concerning the measures, we

did not use continuous measures of emotions during message processing. Therefore we are not able to give deeper insights how fear and guilt responses develop during reading. We also focused on perceived threat and willingness to sacrifice for climate change as an intentional variable but did not measure actual climate-friendly behavior.

Conclusion

In sum, the frames show very specific effects on emotions and dependent variables. Gain-negative frames seem to be particularly effective to increase willingness to invest in climate protection. Loss frames also have potential to increase willingness to sacrifice but only through negative emotions. The separation of action and outcome dimensions in goal framing is relevant for climate change. Climate change communication should underline the negative outcomes of climate change in order to make the threat salient but at the same time emphasize collective action that precludes collective losses of climate change—a general ban of highlighting costs and threats does not seem necessary nor effective.

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Notes

1. Newman et al. (2012, Study 1, p. 523) labeled the loss-negative frame as negative frame (e.g., “Without sustainable individual, government, and business practices, imagine the consequences for your children and future generations”) and contrasted it with a gain-positive frame labeled as positive frame (e.g., “With sustainable individual, government and business practices, imagine the benefits for your children and future generations”). The experimental study used print advertisements that also presented either a positive or a negative picture.
2. The study compares a gain frame (corresponds to a gain-negative frame, e.g., “By mitigating climate changes, we can prevent further increases in winter floods in maritime regions and flash floods throughout Europe”) to a loss frame (corresponds to a loss-negative frame, e.g., “Without mitigating climate change, we will see further increases in winter floods in maritime regions and flash floods throughout Europe”; Spence & Pidgeon, 2010, p. 664). However, some information in the gain condition mixes up positive and negative consequences

(e.g., “By preventing further sea-level rises, we can prevent the inland migration of beaches and save up to 20% of coastal wetlands, maintaining the habitat availability for several species that breed or forage in low lying coastal areas”; Spence & Pidgeon, 2010, p. 664).

3. We refer to Roy’s largest root instead of Wilks’s lambda, since this is preferred as multivariate significance test with “one group having considerable different mean values on one or more dependent variables from the other groups” (Meyers, Gamst, & Guarino, 2012, p. 234).

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