

Emotional researchers or emotional audiences? The effect of emotions in climate change communication

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ABSTRACT

How should researchers communicate about (politicized) risks, such as climate change? Some argue that researchers should express more emotions to emphasize the seriousness of the climate issue and persuade the public to act. However, there is still a lack of research on the consequences of emotion expressions in research communication. In the current study, we investigated people's evaluations of climate researchers described as being angry or sad when communicating about climate change and whether the effects depend on the researcher's gender. Our results, based on a nationally representative survey experiment (Study 1, $N = 2046$), showed no significant interaction effects between the researchers' gender and emotion expression nor any main effects of gender. However, we did find that information provided by angry researchers was less trusted than information provided by researchers described as expressing sadness or no emotion. Researchers described as angry were further taken less seriously compared to researchers who did not express emotions. Still, the effects were very small and were not replicated in a follow-up study (Study 2, $N = 1219$). In Study 1, we also considered the respondents' own climate emotions. Those reporting stronger anger or sadness both took the researcher more seriously and had higher trust in the provided information. The effects of the respondents' own emotions were far larger than those of the emotion expressed by the researchers. We found no interaction effects for emotion similarity between the researcher and the respondent with regards to taking the researcher seriously. However, those reporting no sadness or low to moderate levels of anger had higher trust in information provided by non-emotional as compared to sad or angry researchers, respectively.

1. Introduction

Some argue that researchers should express more emotions when communicating about climate change to emphasize the risk and push for action (for examples, see Salama & Aboukoura, 2018). Many climate researchers report experiencing negative emotions related to climate change (Tollefson, 2021) and emotionless media appearances may be challenging and seem artificial and cold. When climate scientists appear in media reports, it is not uncommon that they are described as worried, angry, frustrated, or sad. However, there is still a lack of research on how "emotional" researchers are received by the public (see e.g., Salama & Aboukoura, 2018; Taddicken & Reif, 2020; van Doorn et al., 2015b). As the threat of climate change intensifies and the consequences become more severe, research on the role of emotion expression becomes increasingly more relevant.

While the emotional climate speeches delivered by Greta Thunberg and David Attenborough at the UN Climate summit COP26 went viral, emotional appeals are traditionally associated with activism, not research communication. In her book "Generation dread", Britt Wray argues that researchers generally avoid using emotional terms or speaking energetically when talking about climate change exactly because they fear coming across as too activist (Wray, 2022). A bias towards "emotionality" as opposed to "rationality" (Roeser, 2012; Scherer, 2011) might be another reason to suppress emotions in research communication. Since emotions can be used to infer what people value (van Kleef & Côté, 2022), expressing them could seemingly be in discrepancy with the value-free ideal, which emphasizes that researchers should strive for objectivity in their research and limit the influence of (moral, social, or political) values (Reiss & Sprenger, 2017). However, some argue that researchers *should* advocate for climate action

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and that it is neither desirable nor possible to remain objective or value neutral when facing such a severe threat as climate change (Capstick et al., 2022). In line with this, a recent study found that many people think climate scientists should advocate for policies, although it affects their perceived objectivity (Cologna et al., 2021). Previous experimental studies also support that advocacy statements do not necessarily compromise credibility and trust in climate scientists (Kotcher et al., 2017).

The purpose of the current study was to investigate whether researchers described as angry or sad when communicating about climate change are viewed less seriously and whether the information they provide is perceived to be less trustworthy. Specifically, we examine the degree to which these assessments are influenced by the type of emotion (anger versus sadness versus no emotion), the researcher's gender, as well as the climate-related emotions held by the audience.

1.1. Emotional communication

Why might it matter whether a researcher's emotions are described in stories about climate change? Emotions are not just intraindividual symptoms of a person's emotional state, they also have communicative and social functions and effects (Hareli & Hess, 2012; Parkinson et al., 2005; van Kleef & Côté, 2022). According to The Emotions as Social Information (EASI) model (van Kleef, 2009, van Kleef, 2010), emotion expressions can influence an audience through two processes. (1) The process of inference refers to how people use emotional expressions to deduce information about the expresser (such as their appraisals, beliefs, and desires) as well as information about a situation (de Melo et al., 2014; Hareli & Hess, 2010; Lange et al., 2022; van Doorn et al., 2015a). A person's emotional expressions can help reveal what they think of as good and bad, what they value, and how they think a situation should be solved. The process of inference has been referred to in different terms, including *backtracking* and *reverse appraisal* (van Kleef & Côté, 2022). (2) In addition to being a source of information, emotion expressions can influence the audience by eliciting affective reactions (van Kleef, 2009; van Kleef & Côté, 2022). The concept of reciprocal emotional reactions suggests that expressing an emotion such as sadness could lead to similar feelings of sadness among the observers (sometimes referred to as *emotional contagion*). However, emotion expressions can also lead to complementary reactions among the observers (e.g., expressions of anger might elicit feelings of guilt) and evoke sentiments (e.g., expressions of anger leading to dislike) (van Kleef & Côté, 2022).

Research support that emotion expressions do in fact affect other people's emotions, thoughts, and behavior (van Kleef & Côté, 2022; van Kleef & Lelieveld, 2022), and that emotions can be used strategically to influence an audience (van Doorn et al., 2015b). In line with this, emotional appeals can be powerful tools for persuasion, but they can also be seen as manipulative or as irrational states that impair decision-making (Roeser, 2012). How an emotional expression is received depends on whether it matches the applicable *display rules*; whether the expressed emotion is perceived to be reasonable (Scherer, 2011) and appropriate in a given context (van Kleef et al., 2011; Warner & Shields, 2009).

1.2. Anger versus sadness

van Kleef and Côté (2022) emphasize that assessments about the appropriateness of an emotion expression can "... be qualitative (i.e., showing the wrong emotion) or quantitative (i.e., showing the right emotion with the wrong intensity)" (p. 644). Others have highlighted that, in certain contexts, also the absence of emotions can seem inappropriate (Warner & Shields, 2009). Consequently, there is reason to believe that the type of emotion a researcher expresses can influence how they are perceived. In line with the process of reverse appraisal (van Kleef & Côté, 2022), the emotion a researcher expresses can tell the audience something about how the researcher perceives the issue of

climate change (Parkinson et al., 2005).

While both anger and sadness are retrospective and negative emotions that reflect that a situation is seen as bad, there are several differences between them (Frijda et al., 1989; Hareli & Hess, 2010). Anger more specifically indicates that the expresser perceives the situation to be unjust and that an obstacle (someone or something) is interfering with a desired goal. Sadness, on the other hand, indicates that the expresser experiences a loss of something they value. The two emotions are further related to different behavioral reactions or calls to action (Frijda, 1987; Frijda et al., 1989). While anger signifies a need for urgent action and implies the wish to recruit allies, sadness is related to a sense of powerlessness and withdrawal and can be seen as a call for help or social support (Barrett et al., 2016; Hareli & Hess, 2010; Parkinson et al., 2005).

Previous research has found that both enthusiastic (König & Jucks, 2019b) and aggressive (König & Jucks, 2019a) language can make scientists seem less trustworthy and their arguments less credible. People report higher levels of trust in climate scientists if they believe that the scientist aims to inform them about climate change rather than persuade them to take action (Rabinovich et al., 2012). This fits with the notion that people generally do not like to be pressured or persuaded to act on climate change (Chan & Lin, 2022; Palm et al., 2020). Since anger is prototypically action-oriented and associated with a "... wish to force change upon someone" (Fischer & Evers, 2010, p. 350) expressions of anger are likely less well-received than expressions of sadness. Advocating for obliged action based on moral ideals ascribes responsibility, which could trigger negative affective reactions in the observer and lead to more negative evaluations of the communicator. Expressing anger is therefore likely to generally be perceived as more negative compared to sadness or not expressing any emotion.

Hypothesis 1. Researchers described as angry as compared to sad or without emotion are a) taken less seriously and b) the information they provide is trusted less.

1.3. The gender of the communicator

How people react to a researcher being "emotional" might not only depend on the type of emotion they express but also on their gender as emotional display rules can differ between men and women. Research on gender stereotypes has shown that people generally perceive women to both experience and express more emotions as compared to men (Plant et al., 2000) and that this is especially true for passive emotions such as sadness (Fischer, 1993; Plant et al., 2000). One exception is anger, which is seen as stereotypically masculine and believed to be more frequently felt and expressed among men (Fabes & Martin, 1991; Fischer & Evers, 2010; Plant et al., 2000).¹ Further, while men's emotions are perceived to be situational (indicating that a specific issue is important), women's emotions are more frequently attributed as dispositional ("she is emotional"; Barrett & Bliss-Moreau, 2009).

This study does not focus on gender in isolation, but on male and female researchers. Reif et al. (2020) did not find an effect of gender when comparing the perceived trustworthiness (integrity, benevolence, and expertise) of male and female research communicators. In line with this, we do not expect to find a difference in the extent to which male and female researchers are taken seriously or trusted when they do not express emotions. However, the stereotypicality of emotions ("sadness is feminine, anger is masculine") may result in backlash (Rudman et al., 2012) against researchers when they display a gender non-stereotypical emotion. Thus, we could expect angry women and sad men to be taken less seriously and be less trusted than angry men and sad women, respectively. Previous research focusing on other professions supports

¹ There is little evidence in the literature for gender differences in the experience of anger (Fischer & Evers, 2010).

such backlash effects for violating gender stereotypes regarding emotional expressions, particularly when it comes to anger in women (Brescoll & Uhlmann, 2008; Lewis, 2000; Salerno et al., 2018; Salerno & Peter-Hagene, 2015).

On the other hand, there could also be asymmetrical effects across male and female researchers so that women are trusted less and taken less seriously when displaying anger, while men are rewarded for displaying sadness. As women are perceived to more easily feel and express emotions than men, a male researcher expressing emotions while talking about climate change might be interpreted as the situation being severe, while a female researcher might be punished for being “emotional”. Because sadness is a stereotypically feminine emotion (Plant et al., 2000), and men are generally perceived to be less emotional (Barrett & Bliss-Moreau, 2009; Shields, 1991), a man expressing sadness might especially underline the seriousness of a situation.

Hypothesis 2. The female researcher is a) taken less seriously and b) the information she provides is less trusted than the male researcher when described as angry.

Hypothesis 3. The male researcher is a) taken more seriously and b) the information he provides is more trusted than the female researcher when described as sad.

1.4. Audience emotions

Emotions can be relevant at three stages of the research communication process: (1) the emotions of the communicator, (2) the emotional appeal of a message, and (3) the emotions of the audience (Taddicken & Reif, 2020). The main focus of the current paper is the first of these stages. However, we know that people’s own emotions are highly relevant for how they perceive and engage with climate change (see e.g., Brosch, 2021; Brosch & Steg, 2021; Stanley et al., 2021). One relevant question is to what degree the researcher’s expressed emotions are relevant, over and above the audience’s feelings of anger and sadness towards climate change. Another is whether the judgment of “emotional researchers” may differ based on the audience’s own emotions.

Research on persuasion has shown that an audience’s attitudes towards an issue, their previous involvement with it, as well as the similarity between the communicator and the audience, can influence to what degree a message is persuasive (Pornpitakpan, 2004). Both objective (e.g., demographic factors) and subjective (e.g., values, interests, emotions) similarity can influence the degree to which a source is seen as credible (Geiger et al., 2022; King & Sereno, 1973). Of particular interest for the current study, the risk of advocacy in climate change communication may depend on whether the researchers’ values (e.g., related to environmental protection) are shared by the audience (Geiger et al., 2022; Kahan, 2010; Schmidt & Donner, 2017).

In line with this, the degree to which it is perceived as appropriate and justified for a researcher to express anger or sadness when communicating about climate change might be influenced by how the audience themselves feel about the issue. Climate change researchers are likely taken more seriously and the information they provide is likely more trusted among audience members who already agree with their message, independently of the emotion expressed (motivated reasoning; Kunda, 1990).

People who feel anger or sadness towards climate change might prefer that researchers express emotions because it validates their own emotions. Among this group, an absence of emotions could potentially be seen as inappropriate. On the other hand, those who report low levels of sadness or anger towards climate change might be especially negative towards “emotional” researchers. Bloodhart et al. (2019, Study 2) asked respondents to indicate to what degree an emotional (sad, fearful, or angry) response to a clean power policy statement reflected their own feelings toward climate change. The results showed that the preference for an emotional policy statement, as compared to a non-emotional one, was stronger if the emotional message matched people’s own feelings.

In addition to the three hypotheses (Part 1.2 and 1.3), we take an explorative approach to investigate the degree to which the respondents’ own emotions towards climate change influence whether they take the researcher seriously and trust the information the researcher provides.

2. Materials and methods

2.1. Experimental design

We tested our hypotheses in a 2 (researcher gender) x 3 (expressed emotion: none, anger, or sadness) between-groups survey experiment. The respondents were randomly assigned to one of the six versions of the following vignette “Imagine the following situation: A [male/female] researcher is interviewed about climate change in a news program on TV. The researcher states that we are currently not in a position to reach the goal of limiting global warming to below 1.5° [blank] and clearly shows [anger/sadness] that not more is being done”. The question was originally asked in Norwegian. Please see the [Supplementary material](#) for the wording of each of the six vignettes. After reading the vignette, the respondents rated the degree to which they took the researcher seriously and trusted the information that they provided.

2.2. Participants

The experiment was embedded in a larger online survey in May and June 2022 as part of Round 24 of the Norwegian Citizen Panel (NCP) (Ivardsflaten et al., 2022). The survey sample was randomly drawn from the National Population Registry of Norway and is near representative of the adult Norwegian population above the age of 18 ($N = 10,160$). The NCP is divided into random subpanels and our survey experiment was fielded to a sub-sample of $n = 2046$. A formal power analysis was not conducted to determine the sample size. However, the approximate sample size was known before deciding on experimental conditions, and the experiment was designed to secure an appropriate sample size for each cell.² The sub-sample consisted of 49% women, 3% of the respondents were born in 1939 or earlier, 17% between 1940 and 1949, 27% between 1950 and 1959, 23% between 1960 and 1969, 15% between 1970 and 1979, 9% between 1980 and 1989 and 7% in 1990 or later.³ Demographic information by experimental condition is presented in the supplementary material. Neither the gender, $X^2(5, n = 2042) = 4.70 p = .454$, nor the age $X^2(30, n = 2040) = 28.98 p = .519$ distributions differed significantly across experimental groups.

2.3. Measures

Two questions were asked to assess the respondent’s evaluation of the researcher and the information they provided: “To what extent do you take the researcher seriously?” and “To what extent do you trust the information the researcher provides?”. Both questions could be answered on a 5-point scale with the answer categories 1 (*Not at all*), 2 (*To a small extent*), 3 (*To some extent*), 4 (*To a large extent*), and 5 (*To a very large extent*). 8 respondents did not answer the question about trusting the information, while 29 did not answer the question about whether they take the researcher seriously.

The respondents’ own experience of anger and sadness associated with climate change was assessed with the question “When it comes to climate change and everything you associate with it, how strongly do you experience the following emotions?”, with the answer categories 1

² Assessing the issue of power more formally, an analysis in GPower (Faul et al., 2007) show that with 2000 participants, $\alpha = 0.05$ and power set to 0.95 in an ANOVA with six groups (2 Gender X 3 Emotions) we would be able to detect a small effect of $f = 0.09$.

³ A continuous age variable is not available due to potential privacy issues.

(Not at all), 2 (To a small extent), 3 (To some extent), 4 (Strongly), and 5 (Very strongly). Anger ($M = 2.47$, $SD = 1.05$) and sadness ($M = 2.87$, $SD = 1.08$) were listed, and as a part of the same question, the respondents were also asked to indicate their level of hope, fear, and guilt. The respondents were asked to report their own climate emotions before they were presented with the vignette and its follow-up questions. Correlations between the outcomes and all the measured climate emotions can be seen in the [supplementary material](#).

3. Results

3.1. The effect of researcher gender and expressed emotion

The statistical analyses were performed in IBM SPSS 28 (IBM Corp, 2020, Released 2021). Mean scores, standard deviations and 95% confidence intervals across experimental conditions are presented in [Table 1](#). The hypotheses were tested in two two-way ANOVAs to assess the effect of researchers' expressed emotion, researcher gender, as well as their interaction. Survey weights were not used when analyzing the experiment (Miratrix et al., 2018).

In the first ANOVA focusing on the extent to which the researcher was taken seriously, we did not find a significant interaction between the researcher's expressed emotion and researcher gender, $F(2, 2011) = 0.23$; $p = .796$; partial $\eta^2 = 0.000$. Similarly, there was no interaction between the researcher's expressed emotion and researcher gender in predicting trust in the information provided, $F(2, 2022) = 0.342$; $p = .710$; partial $\eta^2 = 0.000$. The lack of significant interaction effects between researcher gender and expressed emotion means that neither [hypothesis 2](#) nor [hypothesis 3](#) were supported. There were no main effects of researcher gender for either taking the researcher seriously, $F(1, 2011) = 0.57$; $p = .450$; partial $\eta^2 = 0.000$, or for trusting the information provided, $F(1, 2022) = 0.66$; $p = .418$; partial $\eta^2 = 0.000$.

There were main effects of researchers' described emotion on both taking the researcher seriously, $F(2, 2011) = 4.73$; $p = .009$; partial $\eta^2 = 0.005$, and on trusting the information provided, $F(2, 2022) = 8.35$; $p < .001$; partial $\eta^2 = 0.008$, providing initial support for [hypothesis 1a](#) and [1b](#). Tukey's HSD post-hoc tests showed that in line with [hypothesis 1a](#) researchers were taken less seriously when expressing anger ($M = 3.38$, $SD = 1.03$) as compared to no emotion ($M = 3.54$, $SD = 0.99$), $p = .009$, 95% CI of mean difference $[-0.29, -0.03]$. We did not find, however, that anger was less effective than sadness ($M = 3.50$, $SD = 0.99$) with respect to the researcher being taken seriously ($p = .083$, 95% CI of mean difference $[-0.24, 0.01]$). In total, there was partial support for [hypothesis 1a](#). In line with [hypothesis 1b](#), the researcher was trusted less when expressing anger ($M = 3.32$, $SD = 1.07$), as compared to no emotion ($M = 3.54$, $SD = 1.00$), $p < .001$ (95% CI of mean difference $[-0.35, -0.09]$) and sadness ($M = 3.49$, $SD = 1.02$), $p = .008$ (95% CI of mean difference $[-0.30, -0.04]$).

3.2. The effect of audience emotions

Looking at the distribution of the respondents' anger and sadness towards climate change, we find that 20% do not experience anger at all, 32% experience it to a small extent, 33% to some extent, 11% strongly, and 4% very strongly. For sadness, 12% answered that they do not experience it at all, 23% to a small extent, 39% to some extent, 20% strongly, and 7% very strongly. Experiences of anger, $F(5, 2002) = 0.42$, $p = .836$, and sadness $F(5, 2014) = 0.43$, $p = .827$, did not differ significantly across the experimental conditions, as would be expected due to the randomization into experimental groups.

We investigated the role of respondents' own climate emotions, as well as possible interactions between respondents' and researchers' emotions, using hierarchical multiple linear regression in Stata 18 (the nestreg: prefix). Interactions were plotted with marginsplot. Two dummy variables were created for the regressions, one representing the effect of angry (1) versus non-emotional (0) researchers, and one

representing the effect of sad (1) versus non-emotional (0) researchers. The respondents' levels of anger and sadness were treated as continuous variables. Note that the correlation between feeling angry and sad was strong ($r = 0.67$) and that the effect of respondents' anger would be larger if sadness was excluded from the models.

Step 1 of the hierarchical regression only included the researcher's emotions, Step 2 added respondents' emotions, and Step 3 the interactions. For the interactions, we specifically focused on emotion similarity (whether feelings of anger influenced the evaluation of angry researchers, and feelings of sadness influenced the evaluation of sad researchers). The full regression results, with unstandardized coefficients, can be found in the [supplementary material \(Table A.4 and Table A.5\)](#).

Predicting the degree to which the researcher is taken seriously, we find a large increase in described variance from Step 1, $R^2 = 0.00$, $F(2, 1982) = 4.45$, $p = .012$, to Step 2 (adding respondent emotions), $R^2 = 0.28$, $F(4, 1980) = 190.58$, $p < .001$. In Step 2, respondent sadness was the strongest predictor, $\beta = 0.42$, $t(1980) = 16.36$, $p < .001$, followed by respondent anger, $\beta = 0.14$, $t(1980) = 5.39$, $p < .001$. Describing researchers as angry still had a negative effect on the level of trust in the provided information $\beta = -0.09$, $t(1980) = -3.87$, $p < .001$ when controlling for the respondents' emotions. The effect of sad researchers was not statistically significant $\beta = -0.03$, $t(1980) = -1.25$, $p = .213$. None of the interactions added in Step 3 were statistically significant and the model was not improved.

Predicting trust in the provided information, we again see a large increase in described variance from Step 1, $R^2 = 0.01$, $F(2, 1989) = 7.72$, $p < .001$, to Step 2, $R^2 = 0.25$, $F(4, 1987) = 168.55$, $p < .001$. Looking at the main effects (Step 2), we find that respondent sadness was the strongest predictor, $\beta = 0.42$, $t(1987) = 16.07$, $p < .001$. Respondent anger had a positive effect $\beta = 0.11$, $t(1987) = 4.06$, $p < .001$, while there was still a negative effect of describing the researcher as angry $\beta = -0.11$, $t(1987) = -4.71$, $p < .001$. Describing the researcher as sad did not have a statistically significant effect $\beta = -0.03$, $t(1987) = -1.13$, $p = .260$. The interactions (added in Step 3) led to an improved model, $R^2 = 0.26$, $F(6, 1985) = 115.29$, $p < .001$, with a small increase in the explained variance. Both the interaction between angry researchers and the respondent's level of anger ($\beta = 0.17$, $t(1985) = 3.11$, $p = .002$) and sad researchers and the respondent's level of sadness ($\beta = 0.18$, $t(1985) = 2.95$, $p = .003$) were statistically significant. The interactions are plotted in [Figs. 1 and 2](#) and show that respondents who felt no sadness or low to moderate levels of anger reported higher trust in the non-emotional condition. Note that these are the effects of the interactions while controlling for the emotion not included in the interaction term.

As seen by the increase in explained variance when including people's own climate emotions, as well as the standardized regression coefficients, the effect of the respondents' emotions, particularly their level of sadness, was far larger than the effect of emotions expressed by the researcher. The descriptions of researchers as angry or sad only mattered for those who were not (strongly) emotionally engaged in the issue of climate change themselves.

3.3. Replication study (study 2)

A limitation of our first study was that the no-emotion control condition was somewhat different from the conditions describing angry or sad researchers. Specifically, the control condition lacked the opinionated statement that the researcher react to the fact that "not more is being done". It is possible that this could have influenced the difference we found between the anger condition and the control condition in Study 1. We therefore decided to replicate parts of the study one year later, in June 2023. The new data collection was also fielded through the Norwegian Citizen Panel (Round 27) (Ivaresflaten et al., 2023), but among a sub-group only including newly recruited respondents, who had not answered our original experiment in 2022. This sub-sample consisted of 51% women, 1% of the respondents were born in 1939 or

Table 1

Mean scores, standard deviations and 95% confidence intervals for taking the researcher seriously and trusting the information provided as a function of the researcher's gender and expressed emotion.

Experimental group		Take the researcher seriously			Trust the information provided		
		M	SD	95% CIs	M	SD	95% CIs
Female researcher	No emotion	3.58	0.98	[3.47, 3.69]	3.58	0.99	[3.47, 3.69]
	Anger	3.39	1.04	[3.28, 3.50]	3.34	1.08	[3.23, 3.46]
	Sadness	3.50	1.03	[3.39, 3.61]	3.49	1.05	[3.37, 3.60]
Male researcher	No emotion	3.51	1.01	[3.40, 3.61]	3.50	1.02	[3.39, 3.61]
	Anger	3.37	1.02	[3.26, 3.48]	3.30	1.06	[3.19, 3.42]
	Sadness	3.50	0.96	[3.40, 3.60]	3.50	1.00	[3.39, 3.60]
Total	No emotion	3.54 _a	0.99	[3.47, 3.62]	3.54 _a	1.00	[3.46, 3.62]
	Anger	3.38 _b	1.03	[3.30, 3.46]	3.32 _b	1.07	[3.24, 3.40]
	Sadness	3.50 _{a, b}	0.99	[3.42, 3.57]	3.49 _a	1.02	[3.41, 3.57]

Note. Means with different subscripts within a column differ significantly at $p < .05$.

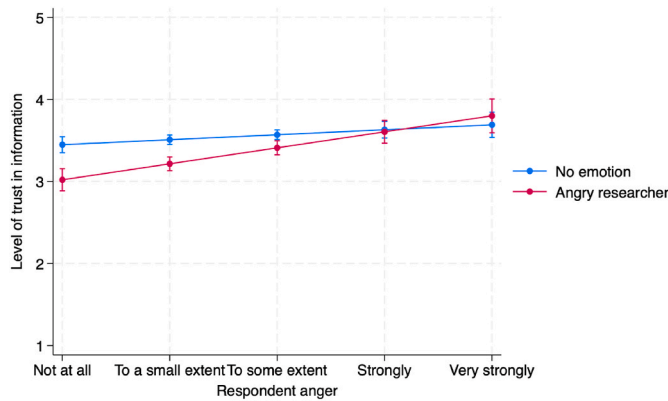


Fig. 1. Predicted trust in the provided information. Interaction between researcher's described emotion and respondents' anger about climate change. Note. Predictive margins with 95% CI.

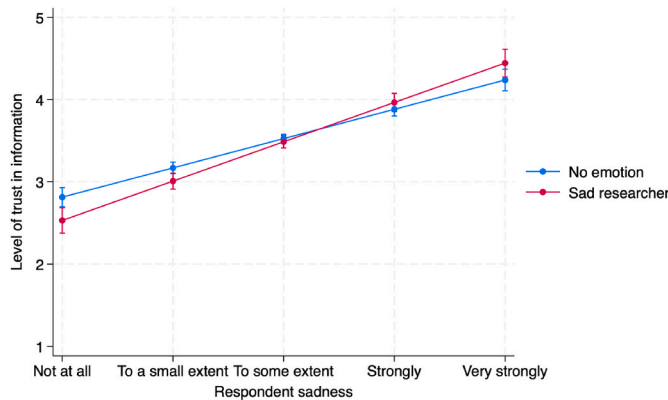


Fig. 2. Predicted trust in the provided information. Interaction between researcher's described emotion and respondents' sadness about climate change. Note. Predictive margins with 95% CI.

earlier, 11% between 1940 and 1949, 24% between 1950 and 1959, 23% between 1960 and 1969, 17% between 1970 and 1979, 12% between 1980 and 1989 and 12% in 1990 or later.

Respondents ($N = 1219$)⁴ were randomly assigned one of three vignettes describing a male researcher. Only the emotion was

⁴ Again, we did not conduct a formal power analysis prior to fielding the replication study. An analysis in GPower (Faul et al, 2007) show with that three groups, 1200 participants, $\alpha = 0.05$ and power set to 0.95 in an ANOVA, we would be able to detect a small effect of $f = 0.11$.

manipulated: "Imagine the following situation: A researcher is interviewed about climate change in a news program on TV. [blank/He is clearly angry/He is clearly sad]. He says we will not reach the goal of limiting global warming to below 1.5° unless more is done". After reading the vignette, the respondents answered the same follow-up questions as in Study 1: "To what extent do you take the researcher seriously?" and "To what extent do you trust the information the researcher provides?". Again, both questions could be answered on a 5-point scale with the answer categories 1 (Not at all), 2 (To a small extent), 3 (To some extent), 4 (To a large extent), and 5 (To a very large extent). A total of $n = 1195$ answered the question about the degree to which they took the researcher seriously and $n = 1198$ the question about whether they trusted the information the researcher provided. The difference between conditions was investigated in the same way as the original study, by comparing means through an ANOVA.

In Study 2, we found no significant differences between the three conditions. The researcher was not taken less seriously when referred to as angry ($M = 3.43, SD = 0.99$) as compared to sad ($M = 3.41, SD = 1.00$) or without emotion ($M = 3.51, SD = 0.99$), $F(2, 1192) = 1.216; p = .297$; partial $\eta^2 = 0.002$. Further, the angry ($M = 3.48, SD = 1.02$) or sad ($M = 3.46, SD = 0.99$) researchers were not trusted less than the non-emotional researcher ($M = 3.54, SD = 1.02$), $F(2, 1195) = 0.643; p = .526$; partial $\eta^2 = 0.001$. Notably, the means for the non-emotional condition are practically identical across Study 1 and Study 2, indicating that the inclusion of the statement that we will not reach the goal of limiting global warming to below 1.5° "unless more is done" did not influence people's answers.

4. Discussion

The goal of this study was to investigate whether researchers described as angry or sad when communicating about climate change are viewed less seriously and whether the information they provide is perceived to be less trustworthy. We examined the degree to which these assessments are influenced by the type of emotion expressed (anger versus sadness versus no emotion), the researcher's gender, as well as the climate-related emotions held by the audience. The results from Study 1 did not support our hypotheses of different evaluations of angry and sad female and male researchers. However, we found that the (type of) expressed emotion can influence people's evaluations. Compared to not describing any emotion or describing sadness, describing the researcher as angry yielded the least amount of trust in the information provided. Anger was also more negative than no emotion, but did not differ from sadness, with respect to taking the researcher seriously. In Study 2, we did not find a statistically significant difference between any of the conditions. One explanation could have been the inclusion of the statement "unless more is done" in the no-emotion condition, and that people reacted to the demand to "do more" rather than the angry researcher in Study 1. However, the means for the no-emotion condition is virtually identical in Study 1 and Study 2. Instead, the main difference

between the studies seems to be that the researcher is less penalized for being angry in the follow-up study, conducted one year later. We found no significant differences between expressing sadness as compared to not expressing emotions in any of the studies. In sum, across the two studies, we demonstrate that describing researchers as angry or sad had either a very small or no effect on the outcomes.

Additional results from Study 1 show that the audience's own climate emotions, especially their level of sadness, were far more important for how they evaluated the researcher. Whether the researcher was described as angry or sad only mattered for respondents who were not emotionally engaged with climate change themselves, and only when predicting their level of trust in the provided information. Specifically, respondents who were not at all sad preferred non-emotional to sad researchers, and those who felt no anger or anger to a small or some extent preferred non-emotional to angry researchers. For anger, this constitutes a large part of the respondents (85% reported feeling no, weak, or moderate anger). Although the interaction effects were relatively small, the results indicate that some groups might see "emotional" researchers as inappropriate. The reason why expressions of anger are punished more than sadness could be that people react negatively to researchers distributing blame and demanding action (as indicated by their anger; Fischer & Roseman, 2007; Frijda et al., 1989) if they do not share their appraisal of the situation. With regards to taking the researcher seriously, the respondents' own anger or sadness did not affect their preference for angry or sad researchers, respectively. Among those who were emotionally engaged with climate change themselves, the researcher was taken seriously and the level of trust in information was high, independent of the emotion description.

The significance of people's own emotions is in line with the process of motivated reasoning (Kunda, 1990), which postulates that reasoning and decision-making are based on emotions and preexisting beliefs rather than an "objective" assessment of new information. Motivated reasoning is frequently used to explain variations in climate change beliefs and acceptance of climate science (e.g., Campbell & Kay, 2014; Druckman & McGrath, 2019; Kahan, 2013; Lewandowsky & Oberauer, 2016). Our findings further align with previous research focusing on the effects of message framing, showing that prior attitudes can have large impacts on the effect of climate change communication (Benjamin et al., 2016; Zhou, 2016). The good and bad news is that describing researchers as angry or sad is not likely to have a clear effect on whether they are taken seriously. However, among some audiences, particularly descriptions of anger may influence the level of trust in the information they provide.

Given the weak and inconsistent effects in Study 1, as well as the failure to replicate our main results in Study 2, we cannot conclude that the findings support our expectation that researchers described as angry are perceived more negatively. Instead, the weak (Study 1) or non-existent (Study 2) effects of angry researchers are more in line with Bloodhart et al. (2019), who show that negative emotions are not necessarily detrimental in climate change communication, and with previous research showing that climate scientists are not necessarily punished for advocacy (Cologna et al., 2021; Kotcher et al., 2017). Because scientists are seen as credible (Hoogeveen et al., 2022) and the public generally recognizes climate change as a serious concern, expressing negative emotions (especially sadness) might not seem inappropriate in the current situation. Still, whether people react to "emotional" researchers will likely depend on how they are confronted with the emotion (e.g., directly versus indirectly; visually, auditorily, or through text). While we find that mere descriptions of a researcher as angry or sad do not initiate a consistent reaction among the audience, it is possible that stronger stimuli will.

In Study 1, we also expected an interaction, whereby the female researcher would receive lower ratings of trust and seriousness than the male researcher when expressing anger or sadness. The absence of an interaction may be due to the role of "researcher" overriding potential gender effects. Social Role Theory predicts that social role information

(e.g., a professional role) attenuates the effect of gender on social perception (Bosak et al., 2012; Eagly & Steffen, 1984). For example, a recent study of gender stereotypes in Norway showed similar stereotypes of female and male academics (Bye et al., 2022). Another potential explanation may lie in cultural differences. In developing our hypotheses, we drew on studies from the U.S. context (e.g., Salerno et al., 2018; Salerno & Peter-Hagene, 2015). While the U.S. and Norway are similar in many respects, they may also differ in ways that could impact how women's and men's emotional expressions are received. Different cultures can have different display rules (Parkinson et al., 2005), and we cannot rule out that such rules differ between the U.S. and Norway.

4.1. Limitations and future research

There are some potential limitations of this study. The Emotions as Social Information (EASI) model (van Kleef, 2009), posits that emotional expressions can influence the audience through the processes of inference and/or affective reactions. While our data cannot answer whether the processes of inference and/or affective reactions influenced the respondents' evaluations, it is likely that a mere description of an angry or sad researcher first and foremost initiates processes of inference. Investigating the process(es) behind the respondents' evaluations could be an interesting avenue for future research.

Future research could further seek to investigate potential differences between descriptions of a researcher's emotions (in text or conversations) versus directly experiencing an emotion display (e.g., in person or through video or sound). Reading about a researcher described as angry or sad is minimal information (other information such as facial expressions, emotional prosody, skin tone, specific choice of words etc. is absent). We were interested in whether people use emotion words (angry/sad) as a cue, for example, to infer the beliefs of the researcher, and found small to no effects. These findings may not generalize to contexts where the information about the researcher's emotions is presented in a different and more vivid way.

Another important avenue is to assess the effect of emotional displays across different mediums. Reif et al. (2020) found that scientists appearing in TV interviews were rated higher with regards to perceived expertise as compared to scientetubers,⁵ but that scientetubers, evaluated as "less typical scientist", were rated as more entertaining and more comprehensible. In contrast to the traditional science communication approach, scientetubers typically use emotions to entertain, engage and connect with their audience (Reif et al., 2020).

While many respondents likely share the researcher's reason to be angry or sad (that "not more is being done" to limit climate change), some might have other reasons for reporting these emotions. Based on the same data collection as Study 1, Gregersen et al. (2023) found that some of the respondents reporting anger in relation to climate change were angry about mitigation measures or skeptical about the threat of climate change. Consequently, respondents' anger or sadness does not always reflect an agreement with the researcher. Rather than (only) looking at emotions, more direct statements, such as "I think more should be done to limit climate change", could be used to measure opinion similarity between the researcher and the respondent.

The vignette text does not clearly state who or what the researcher's sadness or anger is directed at (who should do more?). According to the EASI model, the perceived appropriateness of emotional expressions can depend on whether the emotion is directed at a person or a situation (van Kleef, 2010). Palm et al. (2020) found that people reacted negatively to messages from climate scientists if the scientist emphasized the need for changes in individual behavior. Such messages reduced the reported belief in human-caused climate change and, in the case of messages recommending changes in individual behavior, reduced the

⁵ Scientetubers refers to scientific experts communicating with their audience through online content, such as in YouTube videos (Reif et al., 2020).

reported trust in scientists to report impartial and accurate information. This was not the case for messages that called for measures such as taxing companies, which do not impact individuals directly. Consequently, future studies could differentiate between what or whom the researchers' and audiences' emotions are aimed at.

Further, The EASI model highlights that both the inferences the audience makes based on the emotion expression and the affective reactions it elicits can cause behavioral reactions. Since climate change requires action at the individual and collective level, future research could focus on how emotion expressions can influence people's willingness to engage in pro-environmental behavior, activism, or support climate policies. Changing the outcomes is also likely to change the effect of the audiences' emotions. While we find the respondent's level of sadness to be the strongest predictor of taking the researcher seriously and trusting the provided information, anger has been found to be more relevant for predicting the willingness to engage in activism (Gregersen et al., 2023).

Another goal could be to investigate the degree to which the effect of emotion expression depends on the expressor (e.g., researcher versus activist, politician, or a member of the general public). Focusing on climate anger among the general public, Sabherwal et al. (2021) found that social norm messaging about collective anger can increase public support for climate mitigation across partisan groups.

Finally, the current study is experimental. Future longitudinal studies could look at the impacts of "emotional" researchers over time. Although the current study finds that emotion descriptions are not very impactful, it is possible that it could contribute to changing people's climate change perceptions and emotions in the long run. Further, as climate change continues to have ever more severe impacts on the world, the perceived appropriateness of emotion expressions, as well as public perceptions and emotions towards climate change could change.

4.2. Conclusion

Despite its limitations, the present study has enhanced our understanding of how people evaluate researchers expressing emotions when communicating about risks such as climate change. Our results show that mere descriptions of researchers as being angry or sad when communicating about climate change have minimal or no effects on whether the researcher is taken seriously and whether the information they provide is trusted. Instead, the audience's own climate emotions, especially their level of sadness, are far more important for their evaluations. While emotion descriptions are not likely to make or break a communication strategy, we do find some indications that non-emotional researchers might be preferred, especially compared to angry researchers, among those who are not themselves emotionally engaged with the issue of climate change. We hope our study will stimulate further research focusing on how people perceive and react to "emotional" climate researchers.

Ethics statement

The Norwegian Citizen Panel deals with human subjects and follows the EU General Data Protection Regulation (GDPR). According to this the NCP has conducted a Data Protection Impact Assessment (DPIA), which is approved by the University of Bergen. The DPIA was conducted in cooperation with what is now named Sikt – Norwegian Agency for Shared Services in Education and Research. The DPIA number is 118,868. Participants in the panel provided written informed consent.

In addition, the Scientific Committee of the Norwegian Citizen Panel reviews all questions that are to be fielded in the NCP, reviewing based on ethical issues, scientific issues, and on how the questions will impact the respondent. A separate IRB approval is not necessary in Norway, but the NCP data adheres to national and university-level ethical standards.

Data availability statement

Data from the NCP are (Study 1) or will be (Study 2) available for use in research and education upon request from Sikt - Norwegian Agency for Shared Services in Education and Research. <https://search.nsd.no/en/series/ed271b1c-2595-47e4-8c97-3fcc00f02368>.

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Author contributions

Thea Gregersen: Conceptualization; Formal analysis; Methodology; Project administration; Resources; Validation; Visualization; Writing - original draft; Writing - review & editing.

Hege H. Bye: Formal analysis; Resources; Writing - original draft; Writing - review & editing.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jenvp.2023.102155>.

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