"Never Too Early, Always Too Late": An Experimental Study Exploring the Effects of Hopeful and Fearful Social Media Climate Change Content Doomscrolling on Sustainable Behavior

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Abstract

Objective: This study aimed to investigate how doomscrolling through climate change social media content evoking hope and fear affects attention, engagement, sustainable intentions, and behaviors. By doing so, the study aimed to offer insights into the strategic utilization of emotional appeals in climate change communication on social media.

Method: A 2x2 between-subjects experimental design was employed, encompassing four conditions: hopeful, fearful, combined (eliciting both hope and fear), and a neutral control condition with educational climate content. Participants' attention retention, social media engagement, sustainable intentions, and behaviors were measured and analyzed.

Results: Attention was significantly higher when doomscrolling neutral content than combined content. Furthermore, both hopeful and combined content elicited significantly higher engagement than fearful content, with hopeful content also outperforming neutral content. Hopeful content also resulted in significantly higher sustainable intentions than neutral and fearful content. However, no significant differences were found in behaviors.

Conclusion: When doomscrolling, neutral educational content about climate is great for retaining attention. However, hopeful content, alone or combined with fear, proved to be the best driver of engagement and sustainable intentions.

Recommendations: Advanced methodologies like eye-tracking should be used to gain deeper insights and increase sample sizes for more precise conclusions.

Practical implications: Strategies should use educational content to capture attention to climate topics and use hope, alone or with fear, to increase engagement and sustainable intentions.

Keywords: doomscrolling, climate change, attention, engagement, sustainable intentions, sustainable behaviors

Contents

Introduction

'Never too early, always too late.' This phrase captures the perception that many hold, the belief that efforts to promote sustainability are pointless because it is no longer possible to stop climate change (Garrard, 2019). Despite this perception, climate change remains a significant threat to society, impacting both physical and psychological aspects of people's lives (Ágoston et al., 2022). Therefore, reinforcing behaviors that promote environmental sustainability and planetary health remains crucial (Kennedy-Woodard & Kennedy-Williams, 2022). This can be achieved by sharing news and keeping the population updated (Pearson et al., 2016).

News providers consistently strive to capture the attention of social media users (Ytre-Arne & Moe, 2021). However, when it comes to the topic of climate change, this effort becomes particularly important since social media platforms provide the public with a chance to engage with the issue, which gives them a form of soft power and contributes to the reshaping of public opinion (Mavrodieva et al., 2019). Moreover, when the public pays attention to and engages with the topic of climate change, it ensures that genuine public views are accessible, generating highly relevant data for understanding public sentiments and preferences and ultimately guiding the development of effective environmental policies (Gu et al., 2024).

Therefore, strategies incorporating emotional appeals in content are increasingly prevalent (Ytre-Arne & Moe, 2021), significantly boosting engagement levels (Dolan et al., 2019), and thereby amplifying the impact of climate change discourse. However, scrolling through emotional social media content can also have negative consequences, especially when users engage in doomscrolling, a behavior characterized by persistent scrolling through distressing news, which significantly impacts one's well-being (Price et al., 2022). This tendency of doomscrolling can often be triggered by negative news about climate change, which typically

evokes the emotion of fear, which was used as a primary emotion to communicate climate change in the past (Martel-Morin & Lachapelle, 2022). Historically, this approach to evoking fear was based on the idea that individuals might be motivated to perform desired behaviors to reduce the fear they were experiencing (Boss et al., 2015).

However, the effectiveness of fear-inducing content remains not fully certain (Martel-Morin & Lachapelle, 2022). Some studies emphasize warnings to avoid fear in climate change communication (Maibach et al., 2008), since fearful content can be quite problematic and might emphasize the futility of efforts and lead to paralysis (Roeser, 2012). On the other hand, there are studies showing experimental evidence that supports the effectiveness of fear (Maibach et al., 2008). Therefore, research started incorporating fear in combination with hope (Roeser, 2012). In fact, researchers are increasingly recognizing the efficacy of using hopeful content to address climate change (Nabi & Myrick, 2018), as well as the potential of incorporating a blend of positive and negative emotions in communication to encourage sustainable behaviors (Brosch, 2021).

So far, existing research has predominantly examined the emotional impact of doomscrolling and its associations with mental health issues. Studies have shown that exposure to doomscrolling correlates with higher levels of depression (Price et al., 2022) as well as increased anxiety (Shabahang et al., 2024). However, there is a notable gap in understanding how the emotions elicited by the content during doomscrolling can be leveraged to achieve positive outcomes in terms of formulating desired behavioral intentions and behaviors in specific crises that are being doomscrolled.

Therefore, this study aims to investigate whether doomscrolling content that elicits the negative emotion of fear results in sustainable intentions and behaviors or leads to paralysis.

Additionally, despite doomscrolling typically being associated with scrolling through negative content, this study aims to delve deeper into what would happen if positive content were doomscrolled in the same manner as negative content tends to be. Thus, excessive scrolling through positive, hopeful content will also be referred to as doomscrolling in this study. It will specifically examine whether doomscrolling through hopeful content or a combined hopeful and fearful content may yield better results than purely doomscrolling through negative, fearful content. Understanding this could provide a different perspective on strategically addressing climate change on social media while further filling the theoretical gap regarding how emotions infused in content can influence intentions and behaviors. Therefore, this study offers a new practical perspective on determining which emotions, fear, hope, or a combination of both, are most effective for communicating climate crisis information.

To fill in the research gap and to achieve the objectives previously described, this study aims to answer the main research question: *"How does doomscrolling through hopeful and fearful climate change social media content impact attention retention, drive social media engagement, and influence sustainable behavioral intentions and behaviors?"*.

Theoretical Framework

Doomscrolling Through Social Media Climate Change Content

In today's digital age, users are increasingly scrolling through the vast amount of information available on social media platforms. As they navigate through these platforms, they encounter a diverse range of content. Some of this content, particularly concerning crises, disasters, and tragedies, may lead them to engage in obsessively examining upsetting, depressing, or otherwise negative content, a behavior known as the phenomenon of doomscrolling (Sharma et al., 2022). Doomscrolling can be best described as a compulsive drive

to seek out pessimistic, bad, and foreboding news, which often undermines one's mental well-being (Kaye & Johnson, 2024), contributing significantly to feelings of emotional exhaustion and distress (Price et al., 2022).

Climate change is one of the crises that can trigger this kind of behavior, as individuals increasingly encounter alarming information about climate change threats, such as changes in weather patterns and their resulting ecological, environmental, socio-political, and socio-economic consequences (Abbass et al., 2022). In this instance, encountering climate change information can lead to psychological consequences such as eco-anxiety, eco-guilt, and ecological grief (Ágoston et al., 2022). Additionally, it can pose a significant challenge as individuals may struggle to process negative emotions effectively, hindering actions that are necessary for the planet's well-being (Kennedy-Woodard & Kennedy-Williams, 2022). Moreover, negative emotions may be further intensified if individuals actively engage in climate change information-seeking behaviors, a critical aspect of doomscrolling, wherein they seek out pessimistic news content online (Kaye & Johnson, 2024).

Social Media Influence on Sustainable Intentions and Behaviors

Now that it is clear that climate change is a topic that is often being doomscrolled, it is important to recognize that social media has the power to shape sustainable intentions and behaviors when content about climate change is consumed. Instagram, in particular, emerges as a significant force in shaping pro-environmental attitudes and influencing individuals' inclination towards green consumption, a trend supported by research indicating its predictive power on actual behavior (Jalali & Khalid, 2021). Kumar and Pandey's (2023) findings further underscore the influence of environmental and health considerations on individuals' decisions to adopt sustainable purchasing practices. So, acting as an external influencer, social media serves as a

crucial source of information, impacting consumer motivation and ultimately shaping their intentions to act environmentally friendly (Pop et al., 2020). Based on this, it can be concluded that social media platforms, in general, play a pivotal role in shaping sustainable behavioral intentions and behaviors.

The Role of Emotion in Climate Change Action

While discussing the influence of communicating about climate change on social media, it's important to highlight that incorporating emotions into the content can lead to even better results. Emotions can be defined as adaptive reactions to events or objects deemed relevant to one's concerns, prompting changes in motivational tendencies, physiological responses, expressions, and subjective feelings (Brosch, 2021). However, the influence of emotions extends beyond immediate reactions; they shape perceptions of the world, structure memory, and guide critical decision-making processes (Brosch et al., 2013).

Building upon this understanding, research by Lerner et al. (2015) demonstrates that emotions play a crucial role in decision-making across diverse contexts, challenging the perception that their impacts are random or insignificant. Specifically, within the realm of climate change, emotions prove highly beneficial by enhancing comprehension of its morally significant aspects, intensifying urgency, and motivating proactive behavior (Roeser, 2012).

According to the Elaboration Likelihood Model (ELM), emotions are pivotal in cognition, significantly shaping attitudes and behaviors when individuals engage with persuasive messages (Morris et al., 2005). Additionally, they can play a role in significantly influencing all determinants of behavioral intention according to the Theory of Planned Behavior (TPB) (Berki-Kiss & Menrad, 2022). Therefore, research efforts should prioritize uncovering the causal links between emotions and the adoption of climate-related actions to optimize communication

strategies (Brosch, 2021), especially given the underutilized potential of emotions in fostering sustainable behavior change (Brosch & Steg, 2021). In sum, neutral content lacks the emotional triggers necessary to drive behavior change, whereas emotions can instill a sense of urgency and personal relevance, thereby fostering stronger sustainable intentions and increasing the likelihood of engaging in sustainable behaviors.

Hypothesis 1: Doomscrolling through neutral climate content not aiming to elicit any specific emotions is expected to result in a) lower sustainable behavioral intentions b) fewer sustainable behaviors compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content.

When recognizing the potential benefits of using emotions in climate change communication, it's crucial to know which specific emotions work the best. Fear appeals have traditionally prompted action by highlighting climate change's potential consequences (Nabi & Myrick, 2018). Yet, there is growing acknowledgment of hope's role in driving effective interventions, reframing climate change as a challenge rather than an insurmountable problem (Roeser, 2012), and fostering lasting behavior change (Brosch, 2021). Fear can be problematic, as it may underscore the futility of efforts and lead to paralysis (Roeser, 2012). Nevertheless, some studies do show experimental evidence that supports the effectiveness of fear (Maibach et al., 2008), while, for instance, increasing the sense of urgency (Ribeiro & Schwarzenegger, 2021). Thus, despite fear's common use, it remains uncertain whether emphasizing negative information fosters climate action or induces paralysis (Martel-Morin & Lachapelle, 2022). In summary, hope may be more effective than fear because it can counteract fear-induced paralysis by emphasizing achievable solutions and personal efficacy.

Hypothesis 2: Doomscrolling through hopeful climate change social media content is expected to lead to a) higher sustainable behavioral intentions b) more sustainable behaviors compared to doomscrolling through fearful content.

Next to using purely positive or purely negative emotions, using a balanced mix of positive and negative ones can also promote sustainable behavior (Brosch, 2021). This is because both positive and negative emotions are significant factors influencing how individuals respond to climate change (Salama & Aboukoura, 2018). Positive emotions can motivate people to participate in climate change initiatives, while negative emotions can increase their sense of urgency (Salama & Aboukoura, 2018). Actually, recent research indicates that conveying hope through messages that outline a gap between the present situation and an aspirational goal, coupled with a positive but uncertain outlook, has a distinct impact on persuasion, suggesting an interaction between hope and fear in shaping attitudes and behaviors (Shen et al., 2023). Thus, combining hope and fear can leverage their respective strengths, fears urgency, and hopes advantage of providing motivation through achievable solutions, thereby fostering stronger sustainable intentions and behaviors when experienced together.

Hypothesis 3: Doomscrolling through a combination of hopeful and fearful climate change social media content is expected to result in a) higher sustainable behavioral intentions b) more sustainable behaviors compared to doomscrolling through exclusively hopeful or exclusively fearful climate change social media content.

Managing Attention and Engagement Through Emotional Appeals

Now that it is explained how social media's influence real-world behaviors, it's essential to delve into online behaviors as well. Specifically, discussing the significance of creating content that captures users' attention and enhances engagement on social media remains crucial.

This is because users often scroll through extensive content without fully absorbing it (Baym et al., 2020), making it important to encourage their attention and engagement with climate change content to actually reach behaviours. This engagement can be highly beneficial as it fosters emotional connection with crises, which in turn heightens attention, responsiveness, and acts as a powerful motivator for action (Schneider et al., 2021).

Attention can be defined as a cognitive process involved in selectively processing incoming sensory information, which by itself involves selectively focusing on certain stimuli while filtering out others (Driver, 2001). On the other hand, engagement is a term that is closely connected with attention but is usually correlated with behaviors of activities like commenting, liking, sharing, and viewing content (Dolan et al., 2019). All in all, attention and engagement are closely related in the social media landscape, with attention revolving more around processing information and engagement pertaining to behaviors performed in the online environment.

Having clarified the concepts of attention and engagement, it is crucial to explore how these factors are influenced in the social media news landscape. The process of scrolling through a vast amount of content involves making decisions about which parts of the content are worth paying attention to and which pieces to engage with or disregard (Feng et al., 2015). Consequently, there is an ongoing effort to capture users' attention through various measures (Ytre-Arne & Moe, 2021), such as the application of emotional appeals that can also increase the popularity of a post in terms of likes and comments (Dolan et al., 2019). In this context, emotions are essential components in communicating climate change issues because they significantly influence what garners attention and engagement on social media (León et al., 2022), particularly those that are highly arousing or negative (León et al., 2022).

Hypothesis 4: Doomscrolling through neutral content not aiming to elicit any specific emotions is expected to result in a) lower attention levels b) lower engagement levels compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content.

When attempting to evoke emotional responses, eliciting positive or rewarding emotions is more effective at capturing attention than invoking negative or punishing ones (Gupta, 2019). For instance, a study by Carlson et al. (2020) showed that positive climate change images consistently captured attention, whereas emotionally negative ones did not, indicating that climate change social media content featuring hopeful images may capture attention more effectively than fearful ones. After attention has been captured, social media engagement can be achieved, and hopeful messages excel in this regard by inspiring optimism, garnering public trust and acceptance, thereby fostering support and engagement from the public (Le et al., 2022). Therefore, hope, which can be considered a positive emotion even though it typically arises in negative situations (Bruininks & Howington, 2018), such as the climate change crisis, may be more effective at capturing attention and engagement than fear. This effect is particularly evident in contexts where attention spans are limited (Gupta, 2019), such as during doomscrolling, where users rapidly scroll through large amounts of content. In conclusion, during doomscrolling, hopeful content may have better potential than fear to increase both attention and engagement by providing a positive and optimistic outlook.

Hypothesis 5: *Doomscrolling of hopeful climate change social media content is expected to result in a) higher attention levels b) higher engagement levels compared to doomscrolling of fearful climate change social media content.*

However, it's important to recognize that leveraging a spectrum of emotions, encompassing both positive and negative emotions, can also be a strategy that can significantly

influence how audiences perceive and respond to content (Yi, 2018). Moreover, messages that elicit strong emotional responses, particularly those integrating a blend of positive and negative emotions, have the capacity to break through message fatigue and capture attention effectively (Myrick & Willoughby, 2021). It's observed that posts expressing various emotions are shared more frequently and quickly compared to neutral messages, implying that incorporating a mix of emotions in social media content can be beneficial for enhancing engagement and dissemination of information (Stieglitz & Dang-Xuan, 2013). Thus, a combination of hopeful and fearful content in communicating climate change can create a compelling narrative that maintains attention and encourages engagement.

Hypothesis 6: Doomscrolling of a combination of hopeful and fearful climate change social media content is expected to result in a) higher attention levels b) higher engagement levels compared to doomscrolling of exclusively hopeful or exclusively fearful climate change social media content.

Method

Design

The study aimed to investigate the impact of emotional arousal, specifically fear and hope as independent variables, during the doomscrolling of climate change content on dependent variables including attention retention, social media engagement, sustainable behavioral intentions, and sustainable behaviors. Conducted at the BMS lab of the University of Twente, the study employed a 2x2 between-subjects experimental design with four conditions based on the manipulation of hope (present vs. absent) and fear (present vs. absent). These four conditions included a hopeful condition with posts designed to elicit hope, a fearful condition with posts designed to elicit fear, a combined condition combining hopeful and fearful posts, and a neutral

condition that was used as a control condition and included educational posts about climate that do not elicit any emotions.

The design included the use of quantitative methodologies. First, quantitative methods were employed to assess the influence of independent variables of hope and fear during doomscrolling of climate change social media content on attention and engagement. After that, behavioral intentions and behaviors were also quantitatively evaluated while asking about sustainable intentions and observing the sustainable and non-sustainable choices participants made at the end of the experiment.

Participants

The study included a research population consisting of young adults aged between 18 and 35 who are proficient in English. A total of 120 participants were divided into four distinct doomscrolling conditions. Thus, 30 participants doomscrolled through hopeful climate change content, 30 through fearful climate change content, 30 through combined hopeful and fearful climate change content, and 30 participants were included in a neutral condition consisting of climate content not eliciting emotions. Detailed information about participant demographics per condition can be found in Table 1.

Convenience sampling was employed for participant recruitment, involving both in-person approaches at the University of Twente buildings and online invitations via WhatsApp. Additionally, the SONA Systems platform at the University of Twente was used to gather participants. SONA Systems is an online environment where students can sign up and participate in research studies in exchange for SONA points, which are required for some university courses.

The sample consisted of 50 males and 70 females, with a mean age of 22.87 years. Notably, the sample exhibited diversity in nationality, including 57 Dutch, 28 German, and 35 individuals from other nationalities, including Argentine, Australian, British, Bulgarian, Chinese, Croatian, Egyptian, Indian, Indonesian, Italian, Lebanese, Lithuanian, Polish, Romanian, Slovene, Spanish, Swedish, Turkish, and Ukrainian.

To ensure the robustness of the study, statistical analyses were conducted. A one-way ANOVA showed no significant differences in age across the conditions (F (3,116) =0.46, p=.713, $\eta2$ =.01), while Chi-square test indicated no significant difference in gender distribution ($\chi2$ (1, N=120) =3.33, p=.068). However, the Chi-square test for nationality revealed significant differences in the distribution of nationalities across the conditions ($\chi2$ (2, N=120) =11.45, p=.003).

Additionally, it was tested to see if participants were equally distributed through conditions based on their weekly social media usage, tendency for doomscrolling, and knowledge, attitudes, and perceptions related to climate change. ANOVA results indicated that there was no statistically significant difference both in the amount of time participants spent weekly on social media across different conditions (F (3, 116) = 0.587, p = .625) and in mean doomscrolling scores across the conditions (F (3, 116) = 1.276, p = .286). However, it needs to be pointed out that a significant effect of the condition on participants' scores for climate change perceptions was found (F (3, 116) = 2.731, p = .047).

Table 1

Participant demographics per condition

Condition	Male (n)	Female (n)	Dutch (n)	German (n)	Other (n)	Age	
						M	SD
Hopeful	6	24	12	7	11	23.2	3.72
Fearful	14	16	15	6	9	22.70	2.71
Combined	16	14	15	7	8	23.10	2.37
Neutral	14	16	15	8	7	22.50	2.58

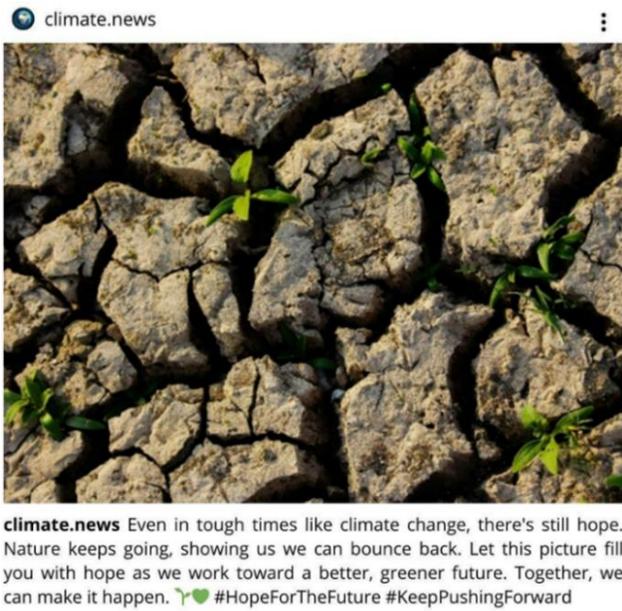*Note*. M = Mean; SD = Standard Deviation.

Stimuli

The stimuli for this experiment consisted of social media posts modified based on the preliminary research survey (Appendix B). Changes made during the pretest ensured that both the images and text used in the posts elicited the desired emotions, depending on the condition. Therefore, the selection and development of stimuli were informed by the research questions, hypotheses, and findings from the pretest.

Each doomscrolling condition included 10 posts designed to resemble typical Instagram posts, created using Canva, a widely used online graphic design platform. Each condition included the same number of posts, but the length of all the posts was not fully the same. Examples of these posts include a hopeful post shown in Figure 1, a fearful post shown in Figure 2, and a neutral post shown in Figure 3.
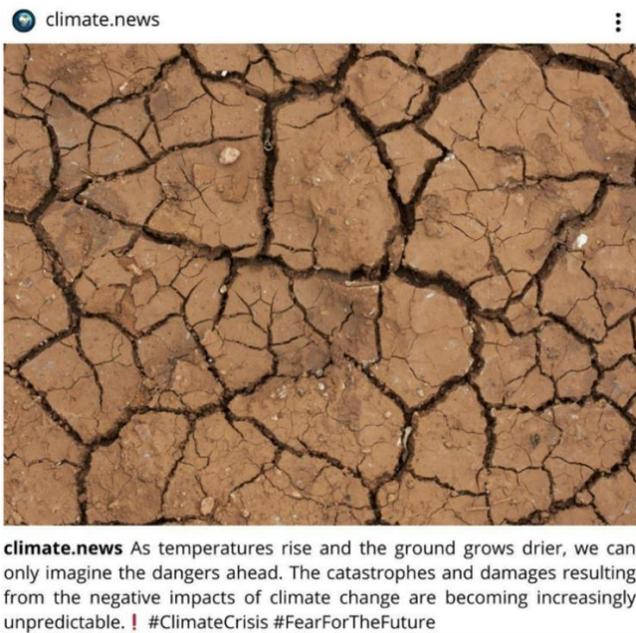
Figure 1

Hopeful post example

climate.news

climate.news Even in tough times like climate change, there's still hope. Nature keeps going, showing us we can bounce back. Let this picture fill you with hope as we work toward a better, greener future. Together, we can make it happen. 🌱💚 #HopeForTheFuture #KeepPushingForward

Figure 2

Fearful post example

climate.news

climate.news As temperatures rise and the ground grows drier, we can only imagine the dangers ahead. The catastrophes and damages resulting from the negative impacts of climate change are becoming increasingly unpredictable. ❗ #ClimateCrisis #FearForTheFuture

Figure 3

Neutral post example

climate.news Climate is the long-term pattern of weather in a particular area. Weather can change from hour-to-hour, day-to-day, month-to-month or even year-to-year. A region's weather patterns, usually tracked for at least 30 years, are considered its climate.
#Climate #EducationalContent #NOAA

Preliminary Research

To ensure doomscrolling through social media content in the final study elicits desired emotions, the pretest survey was filled out by 10 participants. In this pretest survey, ten posts each for hopeful, fearful, and neutral condition were evaluated on a five-point Likert scale ranging from 'strongly agree' to 'strongly disagree'. In the pretest, strongly agree indicated that the post elicited desired emotions fully (see Appendix A).

Preliminary Research Results

All the posts that were on average evaluated as 3 or lower, indicating a negative evaluation, were identified as needing changes. For an overview of the post means per condition, you can refer to Appendix C. Adjustments were made to the photos and texts of these posts to align them with the well-performing posts.

While examining the results of the hopeful content, it was evident that certain posts required adjustments based on their ratings. Specifically, posts Hope_post_2 (M = 2.4, SD = 1.2), Hope_post_4 (M = 3.0, SD = 0.7), Hope_post_5 (M = 2.6, SD = 1.4), and Hope_post_7 (M = 2.4, SD = 1.3) received lower than three average scores, indicating a need for improvement. These findings showed variability in the mean ratings across the hope condition posts, spanning from 2.4 to 4.7. On the other hand, in the fearful content posts, Fear_post_7 (M = 2.7, SD = 1.4) and Fear_post_8 (M = 3.2, SD = 1.1) were identified as posts needing adjustments due to lower average ratings and higher standard deviations. There was also notable variability in mean ratings across the different posts in the fear condition, which ranged from 2.7 to 4.8. However, this variability was lower than it was for the hopeful content. Lastly, in the control condition, posts received the highest overall mean ratings compared to the hope and fear conditions, indicating a consistently positive evaluation. The mean ratings across posts were relatively consistent, ranging from M = 3.7 to M = 4.2, with standard deviations between 0.7 and 1.1. Participants generally agreed that the content was emotionally neutral, suggesting no changes were needed in the control condition posts based on their evaluations.

Procedure

The receiving ethical approval to conduct this study was granted by BMS Ethics Committee of University of Twente. Following that, the data collection took place in the period from May 14th to May 28th of the year 2024. Participants were initially invited to take part in the study either in person or online and given the option to either book a suitable timeslot or proceed immediately. They were briefed on the survey-based nature of the study, which involved answering questions on Qualtrics, a survey creation platform, followed by scrolling through social media content, and concluding with additional survey questions. Additionally, participants

were informed that complimentary snacks and drinks would be provided at the end of the session (see Figure 4).

Following the explanation of the general study procedure, participants were presented with a consent form outlining its purpose and procedures in a manner that did not reveal the full scope of the study to avoid biased responses. Specifically, they were informed that the study aimed to investigate the effects of doomscrolling on individuals, without specifying the examination of sustainable intentions and behaviors. Participants were reminded of their right to withdraw from the study at any point, and voluntary participation was emphasized. Assurances were provided regarding the confidentiality of data collection, with participants informed that their data would be used solely for research purposes. After reviewing the consent form, participants were asked to provide consent before proceeding with the study.

Upon providing consent, participants started by completing the initial survey sections of the experiment. Subsequently, they were randomly assigned to a doomscrolling session and then asked to answer additional survey questions. This marked the conclusion of the online segment of the experiment.

After completing the online part, participants were offered complimentary snacks and drinks, including various types of juices (see Figure 4). They were given the choice between a plastic cup (non-sustainable) and a glass cup (sustainable) when serving themselves juice. The choice of glass was observed and recorded in Qualtrics by the researcher after participants made their selection. Following this, the researcher explained the purpose of the study in its entirety to the participants. They were then asked once more if they consented to being part of the experiment. If not, their data was promptly deleted.

Figure 4

Snacks and drinks provided for participants

Instruments

This section provides an overview of the Qualtrics survey scales and other measures used in the experiment, along with explanations of their adjustments. Initially, demographics, weekly social media usage, knowledge, attitudes, perceptions related to climate change, and doomscrolling were measured to ensure equal distribution of participants across conditions. Subsequently, attention, engagement, future behavioral intentions, and behaviors were measured to address the research questions. Full scales and response options can be found in Appendix B.

Demographics

At the beginning of the experiment, participants answered demographic survey questions selected by the researcher. Items included age, gender, nationality, and the highest level of education completed. This was done to check if the sample characteristics fit the intended sample and ensure an equal distribution of demographics across all conditions.

Weekly Social Media Usage

To measure weekly social media usage, the researcher employed three questions: "How many days in the last 7 days did you use social media?", "On average, how many hours per day have you spent on social media in the last 30 days?", and "Which social media channels do you use?". These questions provided insights into participants' social media habits and ensured a balanced representation of users across different conditions, enhancing the study's reliability.

Knowledge, attitudes, and perceptions related to climate change

Knowledge, attitudes, and perceptions related to climate change were assessed using the Whitmarsh and O'Neill (2010) scale. This included evaluating personal importance ("How important is the issue of climate change to you personally?"), perceived risk ("Do you think climate change is affecting or will affect you personally?"), self-assessed knowledge ("How much do you know about climate change?"), and beliefs about its causes. These measures aimed to comprehensively capture participants' perspectives on climate change and were used to account for potential differences in participant distribution across conditions.

Doomscrolling

To measure doomscrolling, the 15-item scale developed by Sharma et al. (2022) was used. Participants were instructed to indicate the frequency with which statements such as "I feel an urge to seek bad news on social media more and more often" applied to them. This scale effectively captured the frequency and intensity of doomscrolling behaviors among participants, which were important considerations for ensuring proper accounting of participant distribution across conditions.

Attention

The time spent doomscrolling was tracked for each participant using a timing question implemented in Qualtrics on the page where participants scrolled through social media content. This timing question recorded the page submit time, indicating the duration spent from accessing that survey page to exiting it, thus capturing the total time spent scrolling. To ensure that the scrolling time measurement was not influenced by reading the instructions, participants were provided with a description of the scrolling task on the preceding page. Additionally, to mitigate the potential influence of varying post numbers on scrolling time, an equal number of posts were presented in each condition; however, the length of the text within the posts was not always the same so that it captured the usual variability of the posts text length on social media.

Engagement

Engagement was quantified based on the number of likes participants gave while doomscrolling through the social media content. Participants had the option to like each post, and the total number of likes was recorded. To ensure that each condition had an equal likelihood of receiving likes, an identical number of posts were crafted for each condition. Participants could score from 0 to 10 based on their engagement level, corresponding to the total number of posts presented.

Future behavioral intentions

The adapted scale for future behavioral intentions, based on the Whitmarsh and O'Neill (2010) framework, aimed to capture pro-environmental behaviors feasible for the study's predominantly student sample. Respondents were asked to indicate the likelihood of engaging in specific actions, such as turning off lights when not in use and driving economically. Notably, items from the original scale that related to costly or infrastructure-dependent actions such as

installing insulation or renewable energy systems, purchasing low-emission vehicles, or implementing water-saving devices were omitted from the study due to their impracticality for the student sample. Additionally, the scale was adjusted to assess future intentions rather than past behaviors.

Sustainable Behaviors

To record participants' cup choices, the researcher intentionally delayed the appearance of the final survey item by 60 seconds, creating a momentary pause and presenting participants with a fake survey ending to make them believe they had reached the end of the experiment. During this time, participants were able to grab drinks and snacks, and their cup choice was observed by the researcher.

After participants made their choice, the researcher communicated to them that this decision was also part of the experiment and asked if they were still comfortable with participating. Subsequently, the researcher indicated their cup choice in response to the item that appeared by then, "What cup did the participant select?" The response options included the sustainable option (glass cup), the non-sustainable option (plastic cup), or indicating that they did not select any cup. This measure provided valuable insights into participants' real sustainable behaviors in a scenario where they were faced with a tangible choice, reflecting their environmental consciousness in a practical context.

Validity Analysis

To check the validity of the constructs in the scales used in the experiment, factor analysis for the behavioral intentions scale from Whitmarsh and O'Neill (2010) was conducted. This scale was picked for factor analysis since it is the only one that includes categorical items intended to measure the construct that helps in answering the research question. First, it was

checked whether the scale was suitable for factor analysis with the Kaiser-Meyer-Olkin Measure, which indicated its suitability for factor analysis (KMO = 0.811 ≥ 0.50).

Based on the parallel analysis method, it was determined that two factors should be extracted. Only items with loadings greater than 0.30 are considered significant for that factor. These factors collectively explained 37.9% of the total variability in the data, indicating a substantial proportion of variance was accounted for. Factor loadings indicated that the items from the scale load onto two distinct factors, confirming the underlying structure of your measurement of the scale.

Upon examination of the rotated component matrix (varimax), most items loaded significantly on at least one of the factors (see Appendix D). The only item that did not load significantly on either factor was "Intentions_future_15." However, it exhibited a loading of 0.20 on Factor 1, which was close to the 0.30 threshold. Therefore, it was decided to retain this item in the scale.

Reliability Analysis

To assess the reliability of two constructs derived in factor analysis, Cronbach's Alpha was calculated for the behavioral intentions scale from Whitmarsh and O'Neill (2010). The analysis yielded a value of 0.83, indicating excellent internal consistency reliability. This suggests that the items within each construct are highly correlated with each other, signifying that they measure the same underlying construct reliably.

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Results

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The results section covers four main areas: attention, engagement, sustainable intentions, and sustainable behaviors, which supported the acceptance, rejection, or partial acceptance of the hypotheses. For an overview of hypothesis results, refer to Table 2. Attention, engagement, and

sustainable intentions were examined using descriptive statistics and ANOVA, while sustainable behaviors were analyzed using a Chi-Square test. In the analysis, p-values equal to or below .05 were considered significant, whereas those above .05 were considered non-significant.

Attention

First, the study tested three hypotheses regarding attention, those hypotheses included: "H4A: Doomscrolling through neutral content not aiming to elicit any specific emotions is expected to result in lower attention levels compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content." "H5A: Doomscrolling of hopeful climate change social media content is expected to result in higher attention levels compared to doomscrolling of fearful climate change social media content." and "H6A: Doomscrolling of a combination of hopeful and fearful climate change social media content is expected to result in higher attention levels compared to doomscrolling of exclusively hopeful or exclusively fearful climate change social media content."

Results showed that the impact of condition on scrolling time was significant (F (3, 116) = 3.45, p = .019), indicating differences in doomscrolling time across conditions, which supports the general aim behind hypotheses, including H4A, H5A, and H6A. However, the only significant finding was observed in doomscrolling through neutral content (M = 2.42 minutes, SD = 1.16), which was significantly higher than doomscrolling through combined content (M = 1.78 minutes, SD = 0.60) based on Tukey's Honestly Significant Difference (HSD) test (p = .03). Since this is the only significant difference and it does not support any of the hypotheses, H4A, H5A, and H6A were rejected.

Engagement

Moving on to the engagement following hypothesis were tested: "H4B: Doomscrolling through neutral content not aiming to elicit any specific emotions is expected to result in lower engagement levels compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content," "H5B: Doomscrolling of hopeful climate change social media content is expected to result in higher engagement levels compared to doomscrolling of fearful climate change social media content," and "H6B: Doomscrolling of a combination of hopeful and fearful climate change social media content is expected to result in higher engagement levels compared to doomscrolling of exclusively hopeful or exclusively fearful climate change social media content."

The effect of condition on the number of likes received, an indicator of engagement, was analyzed and found to be significant ($F (3, 116) = 11.09$, $p < .001$), supporting the general aims behind all three hypotheses H4B, H5B and H6B. Post-hoc analyses using Tukey's Honestly Significant Difference (HSD) test were conducted to identify which conditions differed significantly. Participants who scrolled through hopeful content ($M = 6.23$, $SD = 2.87$) engaged significantly more compared to those who scrolled through neutral content ($M = 3.63$, $SD = 2.54$) ($p = .001$), providing some support for H4B. However, no significant differences were found between neutral content and fearful ($M = 2.53$, $SD = 2.53$) or combined content ($M = 5.10$, $SD = 2.73$), leading to only partial acceptance of H4B.

Additionally, participants who scrolled through hopeful content ($M = 6.23$, $SD = 2.87$) engaged significantly more compared to those who scrolled through fearful content ($M = 2.53$, $SD = 2.53$) ($p < .001$), fully supporting hypothesis H5B, which was accordingly accepted. Furthermore, participants who scrolled through combined content ($M = 5.10$, $SD = 2.73$)

engaged significantly more compared to those scrolling through fearful content (M = 2.53, SD = 2.53) (p = .002), leading to only partly accepting hypothesis H6B.

Sustainable Intentions

When it comes to sustainable intentions: "H1A: Doomscrolling through neutral climate content not aiming to elicit any specific emotions is expected to result in lower sustainable behavioral intentions compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content.", "H2A: Doomscrolling through hopeful climate change social media content is expected to lead to higher sustainable behavioral intentions compared to doomscrolling through fearful content." and "H3A: Doomscrolling through a combination of hopeful and fearful climate change social media content is expected to result in higher sustainable behavioral intentions compared to doomscrolling through exclusively hopeful or exclusively fearful climate change social media content." were tested.

The results revealed a significant effect of the experimental conditions on behavioral intentions (F (3, 116) = 6.35, p < .001), supporting general ideas behind the H1A, H2A, and H3A hypotheses. Sustainable intentions were significantly higher when participants viewed hopeful content (M = 2.90, SD = 0.39) and combined content (M = 2.74, SD = 0.39) compared to neutral content (M = 2.48, SD = 0.40) (p < .001), providing some support for the H1A. However, no significant differences were found between neutral content (M = 2.48, SD = 0.40) and fearful content (M = 2.62, SD = 0.36), leading to only partial acceptance of H1A.

Additionally, participants showed significantly higher intentions when exposed to hopeful content (M = 2.90, SD = 0.39) compared to fearful content (M = 2.62, SD = 0.36) (p = .04). Therefore, H2A was accepted. Conversely, there were insufficient significant results to support H3A, leading to its rejection.

Sustainable Behaviors

The final hypotheses revolved around sustainable behaviors, the study tested the following hypotheses: "H1B: Doomscrolling through neutral climate content not aiming to elicit any specific emotions is expected to result in fewer sustainable behaviors compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content." and "H2B: Doomscrolling through hopeful climate change social media content is expected to lead to more sustainable behaviors compared to doomscrolling through fearful content." and "H3B: Doomscrolling through a combination of hopeful and fearful climate change social media content is expected to result in more sustainable behaviors compared to doomscrolling through exclusively hopeful or exclusively fearful climate change social media content. "

The results indicated that out of 120 participants, 90 selected a cup (neutral: 23, fearful: 20, hopeful: 24, combined: 23), as not all participants wanted a drink at the end of the experiment. Of those who selected a cup, 52 made sustainable choices (neutral: 11, fearful: 10, hopeful: 14, combined: 17). This means that 47.8% of participants who scrolled through neutral content made a sustainable choice, a lower percentage than those who scrolled through hopeful (58.3%), fearful (50.0%), or combined (73.9%) content, indicating a trend that aligns with hypothesis H1B. Additionally, hopeful content (58.3%) resulted in higher sustainable choices compared to fearful content (50.0%), aligning with hypothesis H2B. Furthermore, combined content (73.9%) led to better outcomes than exclusively fearful (50.0%) or hopeful (58.3%) content, indicating a trend consistent with hypothesis H3B.

However, despite these results aligning with the hypotheses, these differences were not statistically significant according to the Chi-Square test, χ^2 (3, N = 90) = 3.89, p = .27. Therefore, hypotheses H1B, H2B, and H3B still needed to be rejected.

Table 2

Overview of results hypotheses testing

Hypotheses numbers	Hypotheses	Result
H1A	Doomscrolling through neutral climate content not aiming to elicit any specific emotions is expected to result in lower sustainable behavioral intentions compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content.	Partially accepted
H1B	Doomscrolling through neutral climate content not aiming to elicit any specific emotions is expected to result in fewer sustainable behaviors compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content.	Rejected
H2A	Doomscrolling through hopeful climate change social media content is expected to lead to higher sustainable behavioral intentions compared to doomscrolling through fearful content.	Accepted
H2B	Doomscrolling through hopeful climate change social media content is expected to lead to more sustainable behaviors compared to doomscrolling through fearful content.	Rejected
H3A	Doomscrolling through a combination of hopeful and fearful climate change social media content is expected to result in higher sustainable behavioral intentions compared to doomscrolling through exclusively hopeful or exclusively fearful climate change social media content.	Rejected
H3B	Doomscrolling through a combination of hopeful and fearful climate change social media content is expected to result in more sustainable behaviors compared to doomscrolling through exclusively hopeful or exclusively fearful climate change social media content.	Rejected
H4A	Doomscrolling through neutral content not aiming to elicit any specific emotions is expected to result in lower attention levels compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content.	Rejected
H4B	Doomscrolling through neutral content not aiming to elicit any specific emotions is expected to result in lower engagement levels compared to doomscrolling through hopeful, fearful, or a combination of hopeful and fearful content.	Partially accepted
H5A	Doomscrolling of hopeful climate change social media content is expected to result in higher attention levels compared to doomscrolling of fearful climate change social media content.	Rejected
H5B	Doomscrolling of hopeful climate change social media content is expected to result in higher engagement levels compared to doomscrolling of fearful climate change social media content.	Accepted
H6A	Doomscrolling of a combination of hopeful and fearful climate change social media content is expected to result in higher attention levels compared to doomscrolling of exclusively hopeful or exclusively fearful climate change social media content.	Rejected
H6B	Doomscrolling of a combination of hopeful and fearful climate change social media content is expected to result in higher engagement levels compared to doomscrolling of exclusively hopeful or exclusively fearful climate change social media content.	Partially accepted

Discussion

This section discusses the previously described results. It begins by discussing the most interesting results and answering the research question while providing the conclusions for each of the dependent variables studied. Following this, theoretical and practical implications for future research will be discussed. The section will conclude by discussing the limitations of the research and suggesting directions for future studies.

Answering research question and drawing conclusions

This study aimed to investigate how doomscrolling through hopeful, fearful, or a combination of social media climate change content influences attention levels, engagement levels, sustainable behavioral intentions, and actual sustainable behaviors. Additionally, the study explored how climate content that does not elicit any emotions affects these variables. With these objectives, this research aimed to answer the following question: *"How does doomscrolling through hopeful and fearful climate change social media content impact attention retention, drive social media engagement, and influence sustainable behavioral intentions and behaviors?"*.

Firstly, regarding attention retention, an unexpected discovery emerged concerning the performance of neutral content. Despite expectations that messages evoking strong emotional responses, especially those blending positive and negative emotions, would be most effective at breaking through message fatigue and capturing attention (Myrick & Willoughby, 2021), neutral content, featuring purely educational content about climate without specific emotional triggers, outperformed combined content, eliciting both hope and fear in terms of attention retention. However, it's important to note that this neutral content excelled only in capturing attention, not in fostering social media engagement or sustainable intentions. Therefore, it can be concluded

that incorporating an educational aspect into content proves beneficial for capturing attention during doomscrolling, while emotional appeals are more effective in engaging the audience and fostering sustainable intentions.

Results show that emotional appeals were highly effective in promoting engagement and sustainable intentions, as evidenced by the outperformance of the hopeful content and combined content over the neutral content. This underscores the efficacy of emotional appeals in increasing a post's popularity in terms of engagement (Dolan et al., 2019) and the utility of employing a mix of positive and negative emotions in communication to encourage sustainable behavior (Brosch, 2021). However, purely eliciting fear as an emotion was not as effective, which is in line with the studies expressing caution against excessive fear in climate change communication (Maibach et al., 2008) due to its potential to highlight the futility of efforts and induce paralysis (Roeser, 2012).

Furthermore, in terms of engagement and sustainable intentions, hopeful content consistently outperformed both neutral and fearful content, with no significant difference observed between hopeful and combined content. This suggests that hopeful content effectively enhances engagement and promotes sustainable intentions, whether presented alone or in combination with fear. This finding aligns with the recognized efficacy of hope in driving sustainable behavioral changes (Nabi & Myrick, 2018), as well as with theories suggesting that emotional blends in social media content can significantly increase engagement (Stieglitz & Dang-Xuan, 2013).

Additionally, fear consistently underperformed hope in both driving engagement and fostering sustainable intentions, reinforcing the idea that incorporating hope to frame climate change as a challenge rather than an insurmountable problem is crucial (Roeser, 2012).

Therefore, the potential of hope and the potential of combining hope and fear can both be seen as great for both engagement and sustainable intentions, while fear was shown to be worse than hope and worse than combining hope and fear together, so using it alone may not be the best approach.

All in all, the study concludes that when capturing attention to the topic of climate, it is great to use educational content. However, when wanting to influence social media engagement and sustainable intentions, purely educational content is not as effective. In those cases, the use of hopeful content is a great approach, either alone or combined with fear. On the other hand, eliciting only fear for these purposes is less effective. Lastly, conclusions about behaviors were not able to be drawn due to a lack of significant differences between conditions. It is important to collect more data to draw actual conclusions in this area.

Theoretical and practical implications

This study significantly contributes to the theoretical frameworks of the Elaboration Likelihood Model (ELM) and the Theory of Planned Behavior (TPB). ELM posits that individuals first need to pay attention, a process demonstrated in this research to be facilitated by educational content about climate. Subsequently, individuals engage in either central route processing, involving high cognitive involvement, or peripheral route processing, characterized by low cognitive involvement, to reach behavioral changes. This study supports ELM's peripheral route by showing that emotional appeals, particularly hope alone or combined with fear, effectively foster sustainable intentions in climate change communication. By identifying hope as a potent cue that enhances message acceptance and engagement, the study extends ELM's application to environmental communication, highlighting how positive emotions facilitate attitude change and behavior adoption. Additionally, this study enhances the

understanding of the TPB by investigating how emotional appeals, specifically hope and fear, influence behavioral intentions alongside personal attitudes, subjective norms, and perceived control over behavior. The findings indicate that hope, whether presented alone or in combination with fear, plays a significant role in this regard. This contribution underscores the importance of considering emotional appeals within TPB's framework when developing climate change communication strategies to effectively motivate individuals to perform sustainable behaviors.

Beyond theoretical insights, this study offers practical guidance for practitioners on utilizing emotional appeals in climate change communication. It recommends incorporating educational climate content to capture audiences' initial attention and emphasizes using hope to drive engagement and sustainable intentions, with a noted benefit when combined with fear. These insights are pivotal in advancing sustainability efforts and combating climate change by persuading individuals to adopt sustainable behaviors and maximizing the impact of climate-related content. For instance, by understanding which emotional appeals resonate most effectively, content creators can tailor their messages to evoke hope and motivate sustainable behaviors among their followers. Moreover, stakeholders, such as news providers and policymakers, can leverage these insights to enhance their communication strategies and educational initiatives. By aligning their messaging with the emotional dynamics identified in this study, such as the effectiveness of hope and the nuanced impact of combining hope and fear, they can more effectively contribute to action toward achieving sustainability goals at a broader societal level.

Reflection on research limitations and future research

It's crucial to understand that conducting the experiment in a controlled laboratory environment may have influenced participant behavior and responses to some extent. Although this approach ensured experimental control, it may not have perfectly replicated the environment in which participants usually engage in doomscrolling. Therefore, future research should focus on conducting similar studies in more natural settings to enhance validity.

Another important limitation is the varying length of the text in the posts. While this variation may better mimic the actual social media environment, it could also have influenced the attention measure. In a controlled experimental environment, participants may have been more inclined to read all the text presented so longer text in the posts may lead to longer scrolling times. Future research should consider maintaining consistent text lengths to improve reliability or explore methods to balance realism and control in the study design.

Additionally, this research draws conclusions about creating content strategies based on doomscrolling, even though climate change content is encountered in various browsing contexts beyond doomscrolling. To strengthen these conclusions, future research should assess how hopeful, fearful, and emotionally neutral content influences people in different situations, not just during doomscrolling. On the other hand, to explore doomscrolling further, the influence of encountering only one or a few hopeful posts during doomscrolling through negative climate change content could be a good area to explore. Further investigation into video content is also warranted, as this study only examined photos and text formatted similarly to Instagram posts.

Furthermore, assessing attention retention relied on time, however, incorporating additional methodologies such as eye-tracking technology could provide even more valid results. It would be particularly interesting to explore the condition in which both hopeful and fearful

posts are presented and observe which one's participants spend the most time looking at. Additionally, when measuring engagement, it would be beneficial to expand beyond just likes and explore other forms of engagement, such as comments or shares, thus delving deeper into the level of audience interaction with the content.

Another limitation of this research was that the control condition included emotionally neutral educational content about climate but still covered climate topics. It would be beneficial if future research explores doomscrolling through non-climate-related topics that do not elicit any emotions in relation to doomscrolling of the climate change content eliciting. Including a condition in which participants do not engage in doomscrolling at all as a control condition could also be beneficial for future studies. However, it would also be valuable to further explore the potential of educational content in capturing users' attention since this type of content has proven to be highly useful for this purpose. Similarly, eliciting both fear and hope through each post, rather than including a mix of hopeful and fearful posts in the condition, may offer an additional understanding of how these emotions interact and influence when used together.

Lastly, limitations of this research include not reaching enough participants who engaged in the final measurement of behavior. This limitation hindered the ability to draw conclusions about actual behaviors. Future research should aim to include more participants to be able to draw conclusions about behaviors. Additionally, increasing the sample size might lead to more significant results for other measures as well, thereby strengthening the overall validity and reliability of other study's findings.

References

Abbass, K., Qasim, M., Song, H., Murshed, M., Mahmood, H., & Younis, I. (2022). A review of the global climate change impacts, adaptation, and sustainable mitigation measures. *Environmental Science and Pollution Research*, *29*(28), 42539–42559. https://doi.org/10.1007/s11356-022-19718-6

Ágoston, C., Urbán, R., Nagy, B., Csaba, B., Kőváry, Z., Kovács, K., Varga, A., Dúll, A., Mónus, F., Shaw, C. A., & Demetrovics, Z. (2022). The psychological consequences of the ecological crisis: Three new questionnaires to assess eco-anxiety, eco-guilt, and ecological grief. *Climate Risk Management*, *37*, 100441. https://doi.org/10.1016/j.crm.2022.100441

Baym, N. K., Wagman, K. B., & Persaud, C. J. (2020). Mindfully scrolling: Rethinking Facebook after time deactivated. *Social Media + Society*, *6*(2), 205630512091910. https://doi.org/10.1177/2056305120919105

Berki-Kiss, D., & Menrad, K. (2022). The role emotions play in consumer intentions to make pro-social purchases in Germany – An augmented theory of planned behavior model. *Sustainable Production and Consumption*, *29*, 79–89. https://doi.org/10.1016/j.spc.2021.09.026

Boss, S. R., Galletta, D. F., Lowry, P. B., Moody, G. D., & Polák, P. (2015). What Do Systems Users Have to Fear? Using Fear Appeals to Engender Threats and Fear that Motivate Protective Security Behaviors. *Management Information Systems Quarterly*, *39*(4), 837–864. https://doi.org/10.25300/misq/2015/39.4.5

Brosch, T. (2021). Affect and emotions as drivers of climate change perception and action: a review. *Current Opinion in Behavioral Sciences*, *42*, 15–21. https://doi.org/10.1016/j.cobeha.2021.02.001

Brosch, T., Scherer, K. R., Grandjean, D., & Sander, D. (2013). The impact of emotion on perception, attention, memory, and decision-making. *Schweizerische Medizinische Wochenschrift*. https://doi.org/10.4414/smw.2013.13786

Brosch, T., & Steg, L. (2021). Leveraging emotion for sustainable action. *One Earth*, *4*(12), 1693–1703. https://doi.org/10.1016/j.oneear.2021.11.006

Bruininks, P., & Howington, D. E. (2018). Hopeful + Hoping = Hope: unique experiential features in the measurement of emotion. *The Journal of Positive Psychology*, *14*(3), 341–353. https://doi.org/10.1080/17439760.2018.1437465

Carlson, J. M., Kaull, H., Steinhauer, M., Zigarac, A., & Cammarata, J. (2020). Paying attention to climate change: Positive images of climate change solutions capture attention. *Journal of Environmental Psychology*, *71*, 101477. https://doi.org/10.1016/j.jenvp.2020.101477

Dolan, R., Conduit, J., Frethey-Bentham, C., Fahy, J., & Goodman, S. (2019). Social media engagement behavior: A framework for engaging customers through social media content, *European Journal of Marketing*, Vol. 53 No. 10, pp. 2213-2243. https://doi.org/10.1108/EJM-03-2017-0182

Driver, J. (2001). A selective review of selective attention research from the past century. *British Journal of Psychology (1953)*, *92*(1), 53–78. https://doi.org/10.1348/000712601162103

Feng, L., Hu, Y., Li, B., Stanley, H. E., Havlin, S., & Braunstein, L. A. (2015). Competing for Attention in Social Media under Information Overload Conditions. *PLOS ONE*, *10*(7), e0126090. https://doi.org/10.1371/journal.pone.0126090

Garrard, G. (2019). Never too soon, always too late: Reflections on climate temporality. *Wiley Interdisciplinary Reviews. Climate Change (Print)*, *11*(1). https://doi.org/10.1002/wcc.605

Gu, X., Chen, F., Hou, J., Dong, Y., Wang, Y., & Li, J. (2024). Public attention and psychological trends towards waste reduction: A large-scale data analysis based on social media. *Journal of Cleaner Production*, 142873. https://doi.org/10.1016/j.jclepro.2024.142873

Gupta, R. (2019). Chapter 2 – Positive emotions have a unique capacity to capture attention. In N. Srinivasan (Ed.), *Progress in Brain Research* (Vol. 247, pp. 23-46). Elsevier. https://doi.org/10.1016/bs.pbr.2019.02.001

Jalali, S. S., & Khalid, H. (2021). The influence of Instagram influencers' activity on green consumption behavior. *Business Management and Strategy*, *12*(1), 78. https://doi.org/10.5296/bms.v12i1.18265

Kaye, B. K., & Johnson, T. J. (2024). I can't stop myself! Doomscrolling, conspiracy theories, and trust in social media. *Atlantic Journal of Communication*, 1–13. https://doi.org/10.1080/15456870.2024.2316844

Kennedy-Woodard, M., & Kennedy-Williams, P. (2022). *Turn the tide on climate anxiety: Sustainable action for your mental health and the planet*. Jessica Kingsley Publishers.

Kumar, A., & Pandey, M. (2023). Social Media and Impact of Altruistic Motivation, Egoistic Motivation, Subjective Norms, and EWOM toward Green Consumption Behavior: An Empirical Investigation. *Sustainability*, *15*(5), 4222. https://doi.org/10.3390/su15054222

Le, D., Becken, S., & Curnock, M. (2022). Gaining public engagement to restore coral reef

ecosystems in the face of acute crisis. *Global Environmental Change*, *74*, 102513.

https://doi.org/10.1016/j.gloenvcha.2022.102513

León, B., Negredo, S., & Erviti, M. C. (2022). Social Engagement with climate change:

principles for effective visual representation on social media. *Climate Policy*, *22*(8), 976–

992. https://doi.org/10.1080/14693062.2022.2077292

Lerner, J. S., Li, Y., Valdesolo, P., & Kassam, K. (2015). Emotion and decision making. *Annual*

Review of Psychology, 66(1), 799–823. https://doi.org/10.1146/annurev-psych-010213-

115043

Maibach, E., Roser-Renouf, C., & Leiserowitz, A. (2008). Communication and Marketing as

Climate Change–Intervention Assets. *American Journal of Preventive Medicine*, *35*(5),

488–500. https://doi.org/10.1016/j.amepre.2008.08.016

Martel-Morin, M., & Lachapelle, É. (2022). Code red for humanity or time for broad collective

action? Exploring the role of positive and negative messaging in (de)motivating climate

action. *Frontiers in Communication*, 7. https://doi.org/10.3389/fcomm.2022.968335

Mavrodieva, A. V., Rachman, O. K., Harahap, V. B., & Shaw, R. (2019). Role of social media as

a soft power tool in raising public awareness and engagement in addressing climate

change. *Climate*, *7*(10), 122. https://doi.org/10.3390/cli7100122

Morris, J. D., Woo, C., & Singh, A. (2005). Elaboration likelihood model: A missing intrinsic

emotional implication. *Journal of Targeting, Measurement and Analysis for Marketing*,

14(1), 79–98. https://doi.org/10.1057/palgrave.jt.5740171

Myrick, J. G., & Willoughby, J. F. (2021). A Mixed Methods Inquiry into the Role of Tom

Hanks' COVID-19 Social Media Disclosure in Shaping Willingness to Engage in

Prevention Behaviors. *Health Communication*, *37*(7), 824–832.

> https://doi.org/10.1080/10410236.2020.1871169

Nabi, R. L., & Myrick, J. G. (2018). Uplifting Fear Appeals: Considering the role of hope in

> Fear-Based Persuasive messages. *Health Communication*, *34*(4), 463–474.

> https://doi.org/10.1080/10410236.2017.1422847

Pearson, E., Tindle, H., Ferguson, M., Ryan, J., & Litchfield, C. (2016). Can we tweet, post, and

> share our way to a more sustainable society? A review of the current contributions and

> future potential of #socialmediaforsustainability. *Annual Review of Environment and*

> *Resources*, *41*(1), 363–397. * https://doi.org/10.1146/annurev-environ-110615-090000

Pop, R., Săplăcan, Z., & Alt, M. (2020). Social Media Goes Green—The impact of social media

> on green cosmetics purchase motivation and intention. *Information*, *11*(9), 447.

> https://doi.org/10.3390/info11090447

Price, M., Legrand, A. C., Brier, Z. M. F., Van Stolk-Cooke, K., Peck, K. R., Dodds, P. S.,

> Danforth, C. M., & Adams, Z. W. (2022). Doomscrolling during COVID-19: The

> negative association between daily social and traditional media consumption and mental

> health symptoms during the COVID-19 pandemic. *Psychological Trauma: Theory,*

> *Research, Practice, and Policy*, *14*(8), 1338–1346. https://doi.org/10.1037/tra0001202

Ribeiro, N., & Schwarzenegger, C. (2021). Introduction: Media and Fear—Diachronic,

> Intermedia, and Transcultural Perspectives on a Toxic and Functional Relationship

> during Pandemics, Wars, and Political Crises. In *Global transformations in media and*

> *communication/Global transformations in media and communication research* (pp. 1–

> 15). https://doi.org/10.1007/978-3-030-84989-4_1

Roeser, S. (2012). Risk communication, public engagement, and climate change: a role for emotions. *Risk Analysis*, *32*(6), 1033–1040. https://doi.org/10.1111/j.1539-6924.2012.01812.x

Salama, S., & Aboukoura, K. (2018). Role of Emotions in Climate Change Communication. In: Leal Filho, W., Manolas, E., Azul, A., Azeiteiro, U., McGhie, H. (eds) Handbook of Climate Change Communication: Vol. 1. Climate Change Management. Springer, Cham. https://doi.org/10.1007/978-3-319-69838-0_9

Schneider, C. R., Zaval, L., & Markowitz, E. M. (2021). Positive emotions and climate change. *Current Opinion in Behavioral Sciences*, *42*, 114–120. https://doi.org/10.1016/j.cobeha.2021.04.009

Shabahang, R., Hwang, H., Thomas, E. F., Aruguete, M. S., McCutcheon, L. E., Orosz, G., Khanzadeh, A. a. H., Chirani, B. M., & Zsila, Á. (2024). Doomscrolling Evokes Existential Anxiety and Fosters Pessimism about Human Nature? Evidence from Iran and the United States. *Computers in Human Behavior Reports*, 100438. https://doi.org/10.1016/j.chbr.2024.100438

Sharma, B., Lee, S., & Johnson, B. K. (2022). The dark at the end of the tunnel: Doomscrolling on social media newsfeeds. *Technology, Mind, and Behavior*, *3*(1). https://doi.org/10.1037/tmb0000059

Shen, L., Li, S. S., Sweeney, K., & Lee, D. (2023). Re-visiting hope as a discrete emotion and its role in Persuasion. *Communication Quarterly*, *71*(3), 322–341. https://doi.org/10.1080/01463373.2023.2203827

Stieglitz, S., & Dang-Xuan, L. (2013). Emotions and information diffusion in social media - Sentiment of microblogs and sharing behavior. *Journal of Management Information Systems*, *29*(4), 217–248. https://doi.org/10.2753/mis0742-1222290408

Whitmarsh, L., & O'Neill, S. (2010). Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse pro-environmental behaviours. *Journal of Environmental Psychology*, *30*(3), 305–314. https://doi.org/10.1016/j.jenvp.2010.01.003

Yi, X. (2018). *Mixed emotions: unraveling the effects of positive and negative emotions expressed by organizations in crisis on social media*. https://biblio.ugent.be/publication/8577403

Ytre-Arne, B., & Moe, H. (2021). Doomscrolling, Monitoring and Avoiding: news use in COVID-19 Pandemic lockdown. *Journalism Studies*, *22*(13), 1739–1755. https://doi.org/10.1080/1461670x.2021.1952475

Appendix A

Pretest Output

Pretest Consent Form

You are invited to participate in a pretest for an experimental research study titled **"An experimental study exploring the effects of doomscrolling through social media climate change content"** conducted by the researcher Maja Perhat at the University of Twente BMS Lab. Before you decide whether to participate, it is important that you understand why the pretest is being done and what it will involve. Please read the following information carefully and feel free to contact the researcher if you have any questions.

Purpose of the Pretest: The purpose of this pretest is to improve the elicitation of desired emotions in response to the social media content created by the researcher. This will aid in designing the main experimental study by ensuring that the content effectively evokes the intended emotional responses in the participants.

Procedures: If you agree to participate, you will be asked to evaluate a series of social media climate change content and indicate the emotions they evoke for you. Detailed instructions will be provided before the pretest begins. The pretest will take approximately 10 minutes to complete.

Confidentiality: Your participation in this pretest is confidential. Any information collected during the pretest will be kept strictly confidential and will only be accessible to the researcher involved in the study. Your name will not be associated with any published results.

Voluntary Participation and Withdrawal: Note that participation in this pretest is voluntary. You have the right to withdraw from the pretest at any time, and without providing any reasons, without penalty. Your decision to participate or not to participate will not affect you in any way.

Contact Information: If you have any questions or concerns about this pretest, you may contact the researcher Maja Perhat at the following email address: m.perhat@student.utwente.nl.

By clicking the box below, you can indicate that you have read the above information, have had the opportunity to ask questions, and voluntarily agree to participate in this pretest.

○ I have read the above information and voluntarily agree to participate in this pretest

○ I have read the above information, but I don't want to participate

---

Description On this page, you will find content created by the researcher. Your task is to assess **to what extent each of the social media posts makes you feel hopeful about climate change.**

Post-hope-1

climate.news Even in tough times like climate change, there's still hope. Nature keeps going, showing us we can bounce back. Let this picture fill you with hope as we work toward a better, greener future. Together, we can make it happen. 🌱💚 #HopeForTheFuture #KeepPushingForward

Photo source: https://unsplash.com/

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-2

Photo source: https://pixabay.com/de/

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-3

Photo source: https://www.pexels.com/

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-4

climate.news While the challenges may seem daunting, they also unite us in our determination to create a brighter future. Together, we have the opportunity to enact positive change, to preserve our planet and safeguard the beauty of the world we cherish.💚
#HopefulFuture #ClimateAction #TogetherWeCan

Photo source: Photo source: https://pixabay.com/de/

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-5

climate.news

climate.news Advanced filtration technology is paving the way for cleaner skies. As these solutions become more available, hope fills the air for a future where factories can thrive without harming our environment. Together, let's embrace progress and breathe easier knowing positive change is within reach. 🗞️⭐ #CleanAir #HopefulFuture #ClimateAction

Photo source: https://www.pexels.com/

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-6

climate.news ⋮

climate.news Hope blossoms as we see individuals taking a stand against litter, one piece at a time. With every bag filled, we're closer to reclaiming our streets, parks, and communities. Let's celebrate these acts of care and let them ignite a wildfire of hope for a cleaner, greener world. Together, we're turning the tide against pollution! 🌱♻️
#CommunityCleanup #HopefulFuture #ClimateAction

Photo source: https://www.pexels.com/

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-7

climate.news Electric cars aren't just vehicles, they're sources of hope in the fight against climate change. With each electric car on the road, we're forging a path towards a cleaner, more sustainable future. Let's embrace this electric revolution with optimism, knowing that every mile driven brings us closer to a world where our actions drive positive change for the planet. 🌍⚡ #HopeForClimateChange #DriveGreen

Photo source: https://www.shutterstock.com

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-8

climate.news

climate.news Marching for change, united by hope! 🌍🌞 Climate protests around the world are a powerful reminder that together, we have the strength to demand action and shape a sustainable future. As we raise our voices for the planet, we ignite a flame of hope for meaningful change. 🌱💚 #ClimateActionNow #HopefulProtests

Image source: https://www.voicesofyouth.org/blog/my-poems-are-not-guilty

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This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-9

climate.news

climate.news Even as ice melts, hope remains. Let's see it as a call to action, a chance to unite and protect our planet. Together, we can reverse this trend and create a future where ice endures and our planet thrives. 🌍 ❄ #HopeForIce #ClimateAction

Photo source: Photo source: https://pixabay.com/de/

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Post-hope-10

climate.news In the face of raging flames, our firefighters stand as a pieces of hope. Their bravery and resilience inspire us to unite against the threat of forest fires. Together, let's honor their courage by taking action to prevent and mitigate these disasters, ensuring a safer, greener future for all. 🌲👩‍🚒🔥 #HeroesOfNature #HopeForForests #HopeForTheClimate

Photo source: https://www.pexels.com/

This post makes me feel hopeful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

End of Block: Hope-condition

Start of Block: Fear-condition

Description On this page, you will find content created by the researcher. Your task is to assess **to what extent each of the social media posts makes you feel fearful about climate change.**

Fear-post-1

climate.news As temperatures rise and the ground grows drier, we can only imagine the dangers ahead. The catastrophes and damages resulting from the negative impacts of climate change are becoming increasingly unpredictable. ❗ #ClimateCrisis #FearForTheFuture

Photo source: Photo source: https://pixabay.com/de/

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Fear-post-2

Photo source: Photo source: https://pixabay.com/de/

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Fear-post-3

climate.news

climate.news Seeing trash scattered across our beaches instills fear, a chilling reminder of the climate crisis. This isn't just about pollution; it's about the terrifying consequences of climate change. The danger is clear, the risks extreme. 🗑 #FearForTomorrow #Climate #Pollution

Photo source: https://www.pexels.com/

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Fear-post-4

climate.news As floodwaters rise, the terrifying truth of climate change hits. We're facing the loss of everything we cherish. We can only fear what is going to come. 🌊 #ClimateCrisis #FearTheFuture

Photo source: Photo source: https://pixabay.com/de/

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Fear-post-5

climate.news The factories' smog fills us with fear, a stark sign of the crisis. It's not just pollution; it's a frightening consequence of industry. Urgent action is needed or we will face a future of choking air and irreversible damage. 😔 #FearForTheAir #ClimateCrisis

Photo source: https://www.pexels.com/

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree
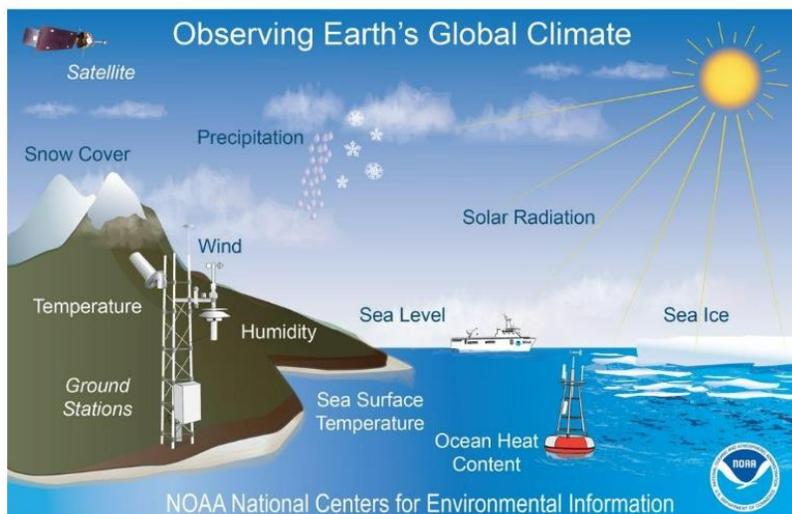
○ Somewhat agree

○ Strongly agree

Fear-post-6

climate.news Every day, scenes like this grow increasingly terrifying, amplifying that there is almost no fate left for our planet. 💔
#ClimateCrisis #FearTheFuture #TakeAction

Photo source: https://unsplash.com/

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Fear-post-7

climate.news

climate.news The sight of cars spewing exhaust fumes triggers fear, a direct result of the pollution crisis. It's not just about transportation, it is a scary consequence of our reliance on fossil fuels. 🚗
#CarPollution #FearFofTheAir

Photo source: https://www.vecteezy.com/free-photos/car-emissions

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Fear-post-8

climate.news Despite the uproar of environmental protests, change for better feels distant. It's a warning that the crisis at hand is fragile, where urgent action is needed, but progress is slow. 🚩
#EnviromentalProtest #SlowProgress

Photo source: https://www.pexels.com/
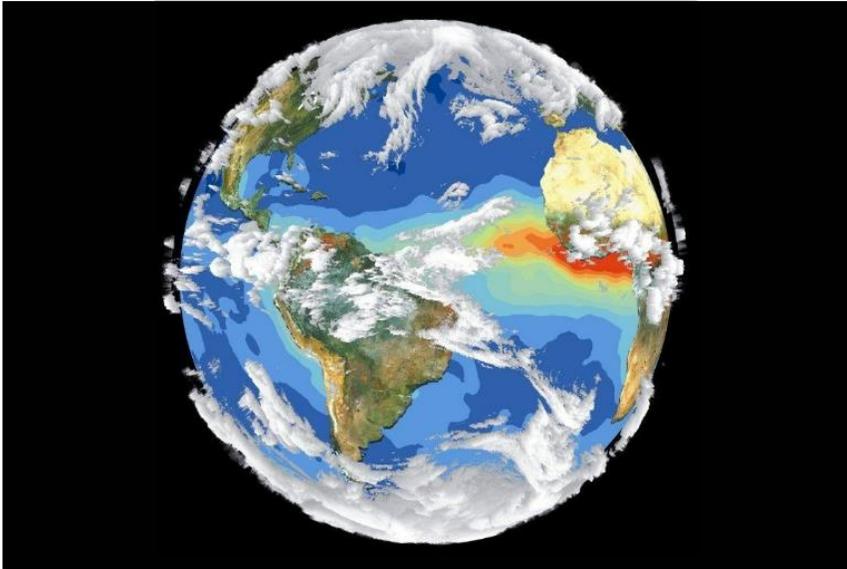
This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Fear-post-9

climate.news In the face of climate change, fear grips us as the ice melts and the seas rise. It's a warning that the crisis is upon us. 🧊
#Climate Change #MeltingIce

Photo source: https://www.pexels.com/

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Fear-post-10

climate.news More forests disappear every day because of the climate crisis we caused. It's really scary to think about what's coming next. 🔥 #FearForTheFuture #ForestFire

Photo source: https://www.shutterstock.com/

This post makes me feel fearful about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

End of Block: Fear-condition

Start of Block: Control condition

Description On this page, you will find content created by the researcher. Your task is to evaluate **if the content makes you feel any emotions related to climate change.**

Control-post-1

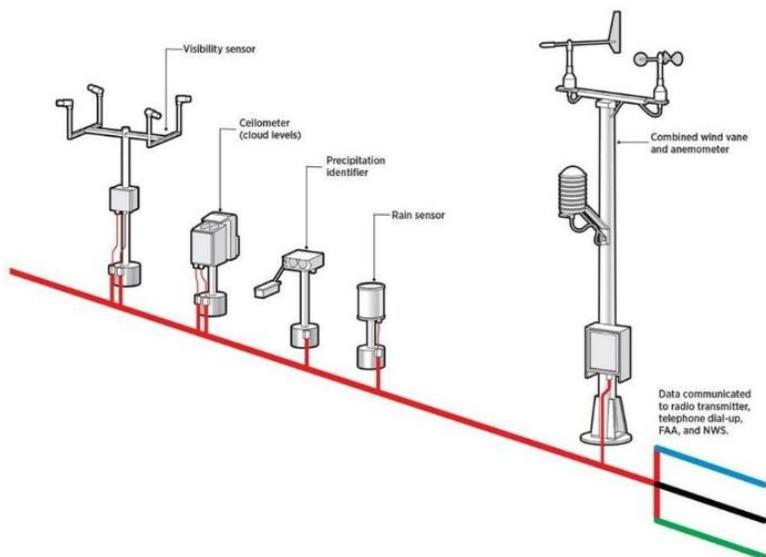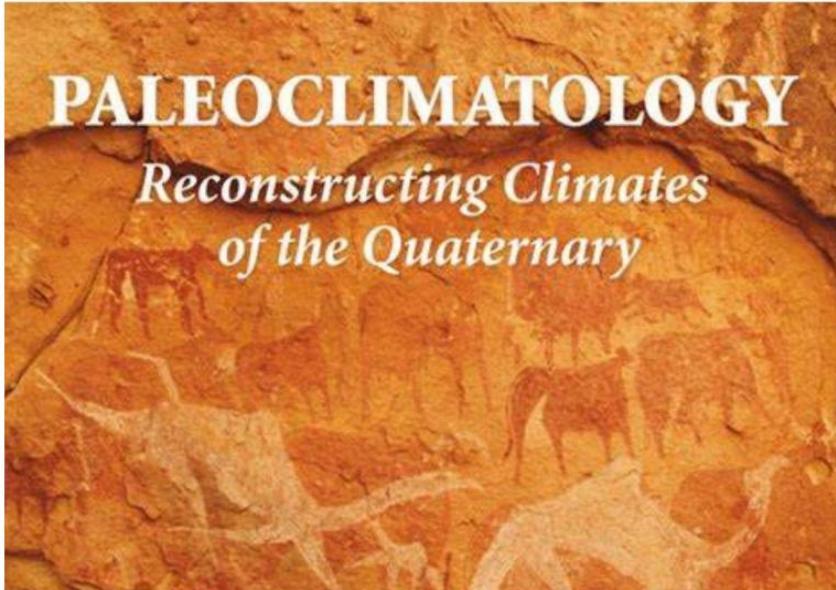Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Control-post-2

climate.news

Climate is what you expect, weather is what you get

climate.news Whereas weather refers to short-term changes in the atmosphere, climate describes what the weather is like over a long period of time in a specific area. Different regions can have different climates. To describe the climate of a place, we might say what the temperatures are like during different seasons, how windy it usually is, or how much rain or snow typically falls. #ClimateVsWeather #Facts #NationalCentersForEnvironmentalEducation

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Control-post-3

climate.news How can we learn about climate in the future? Climate scientists project future climate changes by studying how energy moves between different elements like solids, liquids, and gases. They use computer models to simulate these interactions based on physical laws, helping predict how factors like changes in atmospheric composition will impact global climate. #Climate #Future

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Control-post-4

climate.news Observers and automated stations measure weather conditions at thousands of locations every day of the year. Some observations are made hourly, others just once a day. Over time, these weather observations allow us to quantify long-term average conditions, which provide insight into an area's climate. #EducationalContent #AutomatedStations#ClimateAndWeatherMeasurment

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Control-post-5

climate.news Do you know how past climates are being studied? Paleoclimatology, a study of changes in climate throughout Earth's history, uses evidence found in tree rings, ocean sediment, coral reefs, and layers of sedimentary rocks to do so. #NASA #Climate #Research

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

◯ Strongly disagree

◯ Somewhat disagree

◯ Neither agree nor disagree

◯ Somewhat agree

◯ Strongly agree

Control-post-6

climate.news Climate is measured by observing air, land, and ocean. Surface air temperature, typically taken about 2 meters above the ground, is measured with thermometers shielded from sunlight. The common type is the liquid-in-glass thermometer, while more precise ones, like the air temperature sensor shown on the photo, check electricity through metal samples. #Climate #ObservingAir #ClimateAndWeatherMeasurment

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Control-post-7

climate.news

climate.news Rain gauges are the most common instrument used to measure rainfall. A rain gauge is an open-at-the-top container that is calibrated to measure the depth of liquid caught. In the United States, the depth of precipitation is reported in inches. Satellite instruments can also detect and estimate precipitation amounts. #RainfallMeasuring #Climate

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Control-post-8

climate.news Snow cover is the amount of snow on the ground, usually shown as a percentage. It's important in the Northern Hemisphere because it reflects a lot of sunlight, impacting the climate. Snow is much more reflective than bare ground, so when it melts in spring, the ground warms rapidly. Satellites and ground instruments, like snow pillows shown on the photo, measure snow cover, depth, and water content.
#Climate #SnowPillows #ClimateAndWeatherMeasurment

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Control-post-9

climate.news Temperature (SST) is defined as the skin temperature (top 2 mm) of the ocean. Historically, ships measured sea surface temperature directly, and later, buoys were fitted with thermometers to check the temperature of surface waters. Instruments on satellites, like the one shown on the photo, now remotely measure SST for the whole world every day. #Satelites #OceanTemperature #ClimateAndWeatherMeasurment

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

Control-post-10

climate.news The color of the ocean can be strongly influenced by the presence of microscopic algae (phytoplankton) that contain chlorophyll. When populations of phytoplankton have the right combination of nutrients, sunlight, and water temperatures, they can explode into "blooms" large enough to be visible from space. Additionally, phenomena such as suspended sediments and solutions of dissolved natural materials can affect ocean color. Instruments on satellites measure ocean color from space. #OceanColor #ClimateAndWeatherMeasurment

Photo and text source: https://www.climate.gov/

This post makes me feel no emotions about climate change.

○ Strongly disagree

○ Somewhat disagree

○ Neither agree nor disagree

○ Somewhat agree

○ Strongly agree

End of Block: Control condition

End of Survey

We thank you for your time spent taking this survey.

Your response has been recorded.

Appendix B

Main Experiment Output

Consent Form

You are invited to participate in an experimental research study titled **"An experimental study exploring the effects of doomscrolling through social media climate change content"** conducted by the researcher Maja Perhat at the University of Twente BMS Lab.

Before you decide whether to participate, it is important that you understand why the research is being done and what it will involve. Please read the following information carefully and feel free to contact the researcher if you have any questions.

Purpose of the Study: The purpose of this study is to assess the effects of doomscrolling, defined as excessive scrolling through negative crisis-related content, while exposing participants to different types of social media climate change content. The study aims to determine the impact of this excessive scrolling on individuals and how these effects can be leveraged for positive purposes in the future, specifically in forming effective social media content strategies for climate communication.

Procedures: If you agree to participate, you will be asked to first fill in the pre-survey. After that, you will participate in the doomscrolling session where you will read and scroll through social media content and have the option to like it. After the doomscrolling session, the post-survey will follow, where you will be asked to answer some additional questions. Detailed instructions will be provided before each part of the study. The experiment will take approximately 15 minutes to complete.

Risks and Benefits: The anticipated risks of participating in this study are only associated with the potential distress sensitive climate change content during doomscrolling can cause. However, your participation will help in advancement of knowledge for future strategies in communicating such sensitive social media content about crisis. Additionally, all the participants are provided with free drinks and snacks at the end of the experiment.

Confidentiality: Your participation in this study is confidential. Any information collected during the course of the study will be kept strictly confidential and will only be accessible to the researcher involved in the study. Your name will not be associated with any published results.

Voluntary Participation and Withdrawal: Note that participation in this study is voluntary. You have the right to withdraw from the study at any time, and without providing any reasons, without penalty. Your decision to participate or not to participate will not affect you in any way.

Contact Information: If you have any questions or concerns about this study, you may contact the researcher Maja Perhat at the following email address: m.perhat@student.utwente.nl.

By clicking the box below, you can indicate that you have read the above information, have had the opportunity to ask questions, and voluntarily agree to participate in this study.

○ I agree to participate in the study.

○ I do not agree to participate in the study.

End of Block: Consent-form-block

Start of Block: Demographics-block

Please indicate your age.

_____

Please indicate your gender.

○ Male

○ Female

○ Non-binary / third gender

○ Prefer not to say

Please indicate your nationality.

○ Dutch

○ German

○ Other _____

What is the highest level of education you have completed?

○ High school diploma or equivalent

○ Bachelor's degree

○ Master's degree

○ Doctoral degree

End of Block: Demographics-block

Start of Block: Climate-change-knowledge-attitudes-perceptions-block

How important is the issue of climate change to you personally?

○ Very important

○ Moderately important

○ Slightly important

○ Not at all important

Do you think climate change is something that is affecting or is going to affect you, personally?

○ Yes

○ No

○ I don't know

How much, if anything, would you say you know about climate change?

○ A lot

○ Quite a bit

○ A moderate amount

○ A little

○ Nothing, have never heard of it

Do you think (select one of the options below) :

○ Climate change is caused only by natural processes

○ Climate change is caused only by human activity

○ Climate change is caused by both natural processes and human activity

○ There's no such thing as climate change

○ I don't know what is causing climate change

End of Block: Climate-change-knowledge-attitudes-perceptions-block

Start of Block: Doomscrolling-description-block

Description On the next page, you'll find content resembling Instagram posts. Your task is to scroll through the content and examine it. While scrolling, you can like the posts you see by checking the 'like' box below each post. If you prefer not to like certain posts, simply leave the box unchecked.

End of Block: Doomscrolling-description-block

Start of Block: Hope-content-condition

Timing-hope Timing
First Click
Last Click
Page Submit
Click Count

Hope-post-1

Like-hope-1

◯ Like

Hope-post-2

climate.news As firefighters bravely battle wildfires, our collective efforts to prevent human-caused fires shine as beacons of hope for a brighter future. Armed with fire safety kits, our individual actions in warm, dry climates carry immense power to protect our forests and communities. Together, through #ClimateAction and #FirePrevention, we ignite a blaze of hope that burns brighter than any wildfire. 🌲🔥💚

Like-hope-2

○ Like

Hope-post-3

climate.news

climate.news It's a small but powerful reminder that each action we take can make a positive difference. Let's be inspired by this example and work together to create a cleaner, greener future for our planet. 🌍💚 #ClimateAction #HopeForChange #StopPollution

Like-hope-3

◯ Like

Hope-post-4

climate.news   ⋮

climate.news Hope blooms as communities rally to mitigate rising floods, each sandbag placed drawing us nearer to reclaiming our homes and neighborhoods. Let's honor these displays of resilience and allow them to kindle a blaze of hope for a safer, more resilient future. Together, we're combating disaster head-on! 🌊
#FloodResponse #HopefulFuture #ClimateAction #HopeForChange

Like-hope-4

◯ Like

Hope-post-5

climate.news ⋮
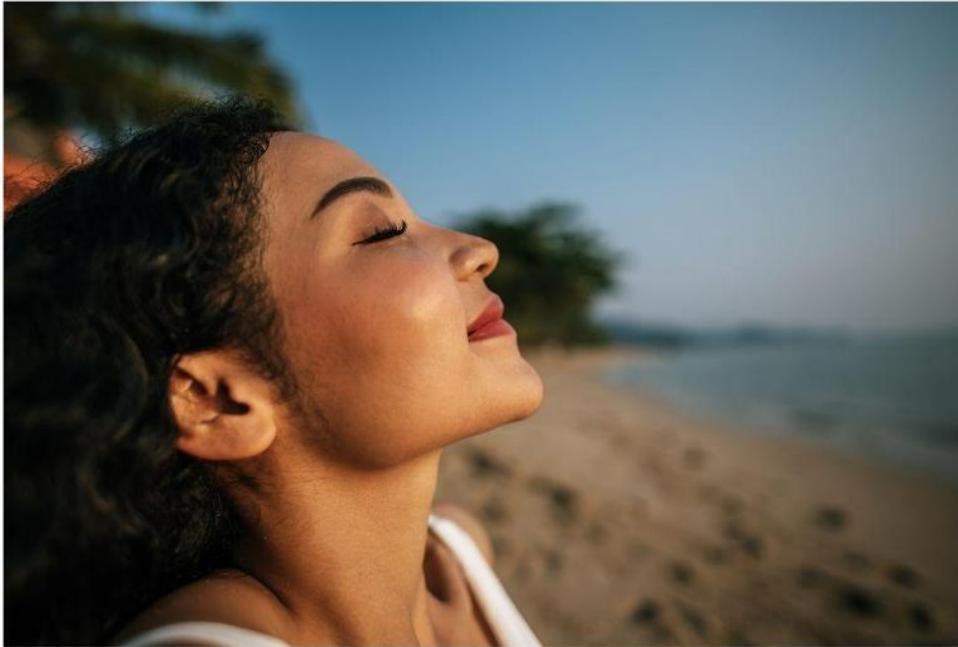
climate.news Clean air isn't just a luxury, it's a vital part of our planet's health and our fight against climate change. 🍃💚 By protecting and preserving our air quality, we're not only safeguarding our own well-being but also nurturing a sustainable environment for generations to come. Together, we can create a world where clean air is a reality for all! 🌍✨ #CleanAir #HopeForChange #ClimateAction #SustainableFuture"

Like-hope-5

◯ Like

Hope-post-6

climate.news

climate.news Hope blossoms as we see individuals taking a stand against litter, one piece at a time. With every bag filled, we're closer to reclaiming our streets, parks, and communities. Let's celebrate these acts of care and let them ignite a wildfire of hope for a cleaner, greener world. Together, we're turning the tide against pollution! 🌱♻️
#CommunityCleanup #HopefulFuture #ClimateAction

Like-hope-6

◯ Like

Hope-post-7

climate.news

climate.news Recycling isn't just about reducing waste, it's a weapon in the fight against climate change! ♻️ By recycling materials like plastic, paper, and glass, we reduce the need for raw materials and energy-intensive manufacturing processes, helping to lower carbon emissions and preserve our planet's resources. Together, through small acts like recycling, we can ignite hope and make a big impact in safeguarding our planet's future! 🌍💚
#Recycle #ClimateAction #SustainableLiving #FightClimateChange

Like-hope-7

◯ Like

Hope-post-8

climate.news   ⋮

climate.news Marching for change, united by hope! 🌍🌎 Climate protests around the world are a powerful reminder that together, we have the strength to demand action and shape a sustainable future. As we raise our voices for the planet, we ignite a flame of hope for meaningful change. 🌱💚 #ClimateActionNow #HopefulProtests

Like-hope-8

◯ Like

Hope-post-9

climate.news

climate.news Even as ice melts, hope remains. Let's see it as a call to action, a chance to unite and protect our planet. Together, we can reverse this trend and create a future where ice endures and our planet thrives. 🌍 ❄️ #HopeForIce #ClimateAction

Like-hope-9

◯ Like

Hope-post-10

climate.news

climate.news In the face of raging flames, our firefighters stand as a pieces of hope. Their bravery and resilience inspire us to unite against the threat of forest fires. Together, let's honor their courage by taking action to prevent and mitigate these disasters, ensuring a safer, greener future for all. 🌲🧑‍🚒🔥 #HeroesOfNature #HopeForForests #HopeForTheClimate

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Like-hope-10

◯ Like

End of Block: Hope-content-condition

Start of Block: Fear-content-condition

Timing-fear Timing
First Click
Last Click
Page Submit
Click Count

Fear-post-1

climate.news As temperatures rise and the ground grows drier, we can only imagine the dangers ahead. The catastrophes and damages resulting from the negative impacts of climate change are becoming increasingly unpredictable. ❗ #ClimateCrisis #FearForTheFuture

Like-fear-1

◯ Like

Fear-post-2

climate.news Look at this scary picture: a forest on fire, a sign of chaos climate change is crating. Let realize how severe the danger is. There are devastating consequences ahead. 🔥🌲
#ClimateEmergency #ScaredOfTheFlames #FearForForests

Like-fear-2

◯ Like

Fear-post-3

climate.news

climate.news Seeing trash scattered across our beaches instills fear, a chilling reminder of the climate crisis. This isn't just about pollution; it's about the terrifying consequences of climate change. The danger is clear, the risks extreme. 🗑 #FearForTomorrow #Climate #Pollution

---

Like-fear-3

○ Like

Fear-post-4

climate.news

climate.news As floodwaters rise, the terrifying truth of climate change hits. We're facing the loss of everything we cherish. We can only fear what is going to come. 🌊 #ClimateCrisis #FearTheFuture

Like-fear-4

○ Like

Fear-post-5

climate.news

climate.news The factories' smog fills us with fear, a stark sign of the crisis. It's not just pollution; it's a frightening consequence of industry. Urgent action is needed or we will face a future of choking air and irreversible damage. 😔 #FearForTheAir #ClimateCrisis

---

Like-fear-5

◯ Like

Fear-post-6

climate.news Every day, scenes like this grow increasingly terrifying, amplifying that there is almost no fate left for our planet. 💔
#ClimateCrisis #FearTheFuture #TakeAction

Like-fear-6

○ Like

Fear-post-7

climate.news

climate.news Imagine a future where climate change ravages our planet, fueled by our neglect of the environment. Landfills overflow with waste, emitting methane—a potent greenhouse gas—into the atmosphere. Oceans are suffocated by plastic pollution, disrupting delicate ecosystems and accelerating global warming. Wildlife struggles to survive in a world stripped of its natural habitats. This apocalyptic vision isn't fiction—it's the chilling reality we face if we continue to ignore the urgent need for recycling. #ClimateChange #NeedForRecycling

Like-fear-7

◯ Like

Fear-post-8

climate.news A world where climate change protests echo through the streets like desperate pleas for survival. But as voices rise, so does the specter of fear. Ignored warnings lead to escalating chaos: extreme weather events batter cities, rising seas threaten coastlines, and ecosystems collapse under the strain. Each protest feels like a race against time. #ClimateCrisis #ProtestForSurvival #FearTheFuture

Like-fear-8

○ Like

Fear-post-9

climate.news In the face of climate change, fear grips us as the ice melts and the seas rise. It's a warning that the crisis is upon us. 🧊
#Climate Change #MeltingIce

Like-fear-9

◯ Like

Fear-post-10

climate.news More forests disappear every day because of the climate crisis we caused. It's really scary to think about what's coming next. 🔥 #FearForTheFuture #ForestFire

---

Like-fear-10

◯ Like

End of Block: Fear-content-condition

Start of Block: Fear-hope-content-condition

Timing-fear-hope Timing
First Click
Last Click
Page Submit
Click Count

Fear-hope-1

climate.news   ⋮

climate.news As floodwaters rise, the terrifying truth of climate change hits. We're facing the loss of everything we cherish. We can only fear what is going to come. 🌀 #ClimateCrisis #FearTheFuture

---

Like-hope-fear-1

○ Like

Fear-hope-2

climate.news **In** the face of raging flames, our firefighters stand as a pieces of hope. Their bravery and resilience inspire us to unite against the threat of forest fires. Together, let's honor their courage by taking action to prevent and mitigate these disasters, ensuring a safer, greener future for all. 🌲🧑‍🚒🔥 #HeroesOfNature #HopeForForests #HopeForTheClimate

Like-hope-fear-2

◯ Like

Fear-hope-3

climate.news

climate.news Seeing trash scattered across our beaches instills fear, a chilling reminder of the climate crisis. This isn't just about pollution; it's about the terrifying consequences of climate change. The danger is clear, the risks extreme. 🗑 #FearForTomorrow #Climate #Pollution

Like-hope-fear-3

⃝ Like

Fear-hope-4

climate.news

climate.news Marching for change, united by hope! 🌍✊ Climate protests around the world are a powerful reminder that together, we have the strength to demand action and shape a sustainable future. As we raise our voices for the planet, we ignite a flame of hope for meaningful change. 🌱💚 #ClimateActionNow #HopefulProtests

Like-hope-fear-4

◯ Like

Fear-hope-5

climate.news

climate.news In the face of climate change, fear grips us as the ice melts and the seas rise. It's a warning that the crisis is upon us. 🧊
#Climate Change #MeltingIce

Like-hope-fear-5

○ Like

Fear-hope-6

climate.news

climate.news Hope blossoms as we see individuals taking a stand against litter, one piece at a time. With every bag filled, we're closer to reclaiming our streets, parks, and communities. Let's celebrate these acts of care and let them ignite a wildfire of hope for a cleaner, greener world. Together, we're turning the tide against pollution! 🌱♻️
#CommunityCleanup #HopefulFuture #ClimateAction

Like-hope-fear-6

○ Like

Fear-hope-7

climate.news ⋮
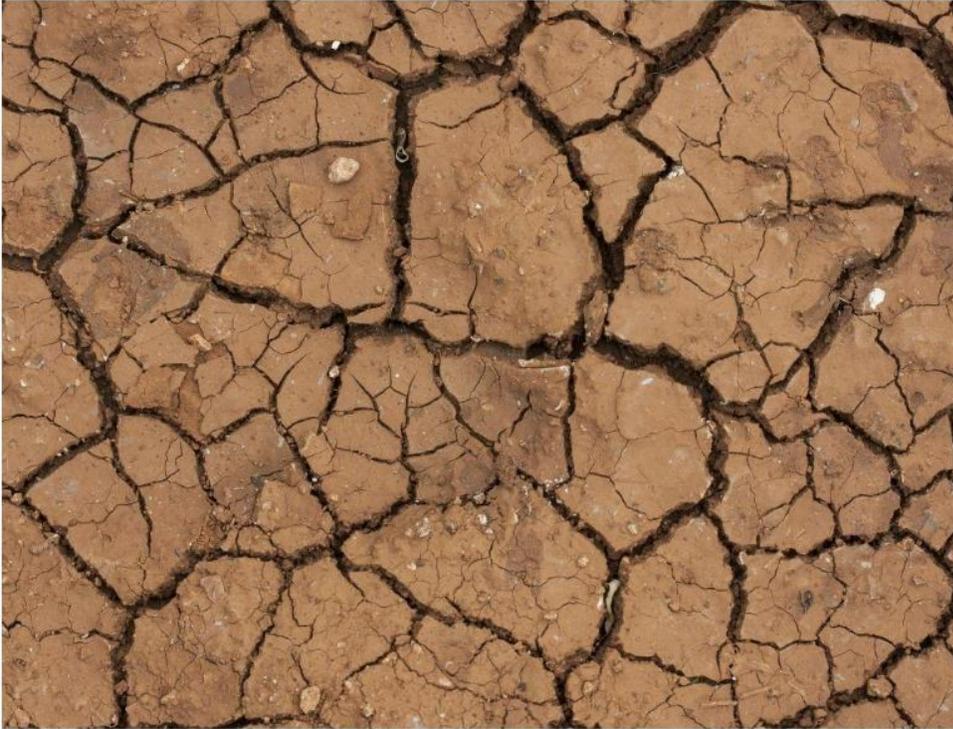
climate.news As temperatures rise and the ground grows drier, we can only imagine the dangers ahead. The catastrophes and damages resulting from the negative impacts of climate change are becoming increasingly unpredictable. ❗ #ClimateCrisis #FearForTheFuture

---

Like-hope-fear-7

○ Like

Fear-hope-8

climate.news It's a small but powerful reminder that each action we take can make a positive difference. Let's be inspired by this example and work together to create a cleaner, greener future for our planet. 🌍💚 #ClimateAction #HopeForChange #StopPollution

Like-hope-fear-8

◯ Like

Fear-hope-9

climate.news ⋮

climate.news The factories' smog fills us with fear, a stark sign of the crisis. It's not just pollution; it's a frightening consequence of industry. Urgent action is needed or we will face a future of choking air and irreversible damage. 😔 #FearForTheAir #ClimateCrisis

---

Like-hope-fear-9

◯ Like

Fear-hope-10

climate.news ⋮

climate.news Even in tough times like climate change, there's still hope. Nature keeps going, showing us we can bounce back. Let this picture fill you with hope as we work toward a better, greener future. Together, we can make it happen. 🌱💚 #HopeForTheFuture #KeepPushingForward

Like-hope-fear-10

◯ Like

End of Block: Fear-hope-content-condition

Start of Block: Control-condition

Timing-control Timing
First Click
Last Click
Page Submit
Click Count

Control-post-1
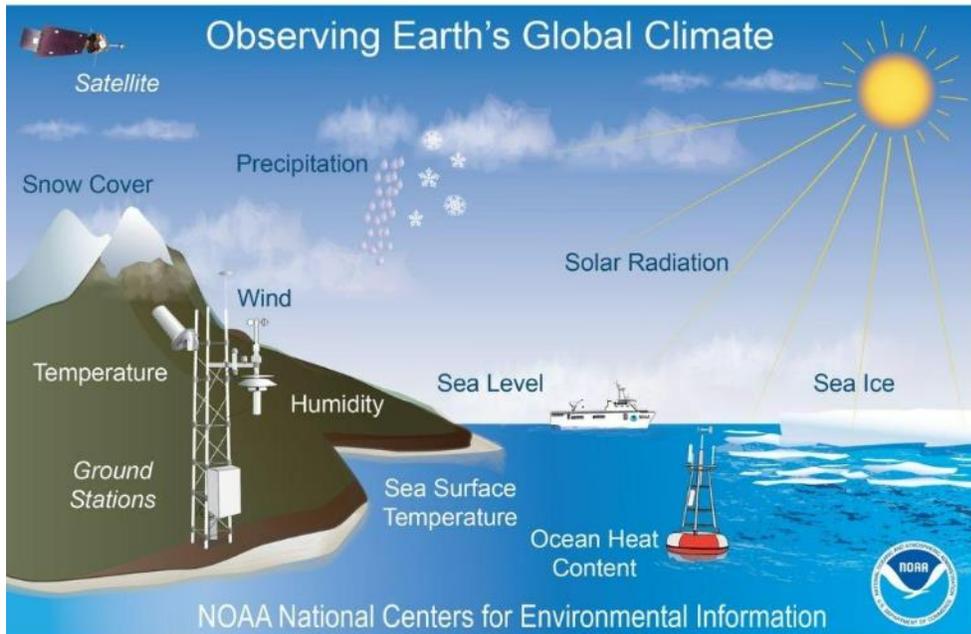
climate.news Climate is the long-term pattern of weather in a particular area. Weather can change from hour-to-hour, day-to-day, month-to-month or even year-to-year. A region's weather patterns, usually tracked for at least 30 years, are considered its climate.
#Climate #EducationalContent #NOAA

Like-control-1

○ Like

Control-post-2

climate.news   ⋮

Climate is what you expect, weather is what you get

climate.news Whereas weather refers to short-term changes in the atmosphere, climate describes what the weather is like over a long period of time in a specific area. Different regions can have different climates. To describe the climate of a place, we might say what the temperatures are like during different seasons, how windy it usually is, or how much rain or snow typically falls. #ClimateVsWeather #Facts #NationalCentersForEnvironmentalEducation

---

Like-control-2

◯ Like

Control-post-3

🌐 climate.news   ⋮
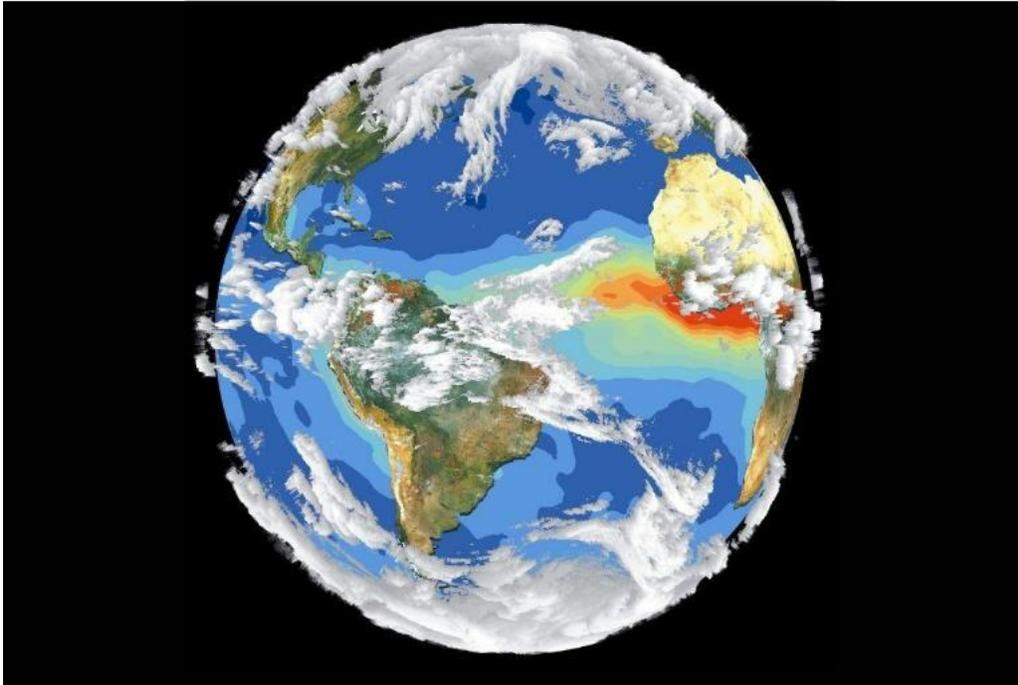
climate.news How can we learn about climate in the future? Climate scientists project future climate changes by studying how energy moves between different elements like solids, liquids, and gases. They use computer models to simulate these interactions based on physical laws, helping predict how factors like changes in atmospheric composition will impact global climate. #Climate #Future

Like-control-3

◯ Like

Control-post-4

🌐 climate.news   ⋮
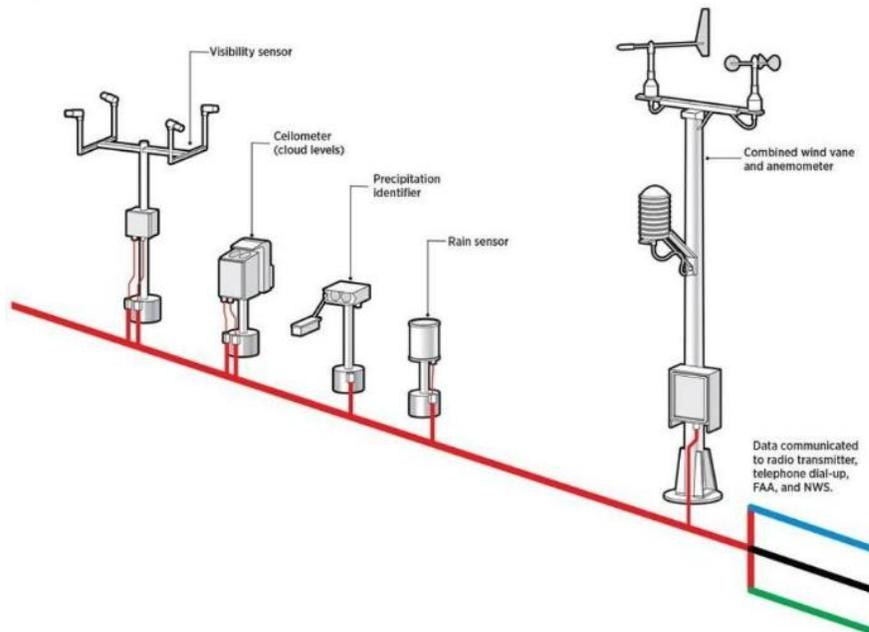
climate.news Observers and automated stations measure weather conditions at thousands of locations every day of the year. Some observations are made hourly, others just once a day. Over time, these weather observations allow us to quantify long-term average conditions, which provide insight into an area's climate. #EducationalContent #AutomatedStations#ClimateAndWeatherMeasurment

---

Like-control-4

◯ Like

Control-post-5

🌐 climate.news   ⋮
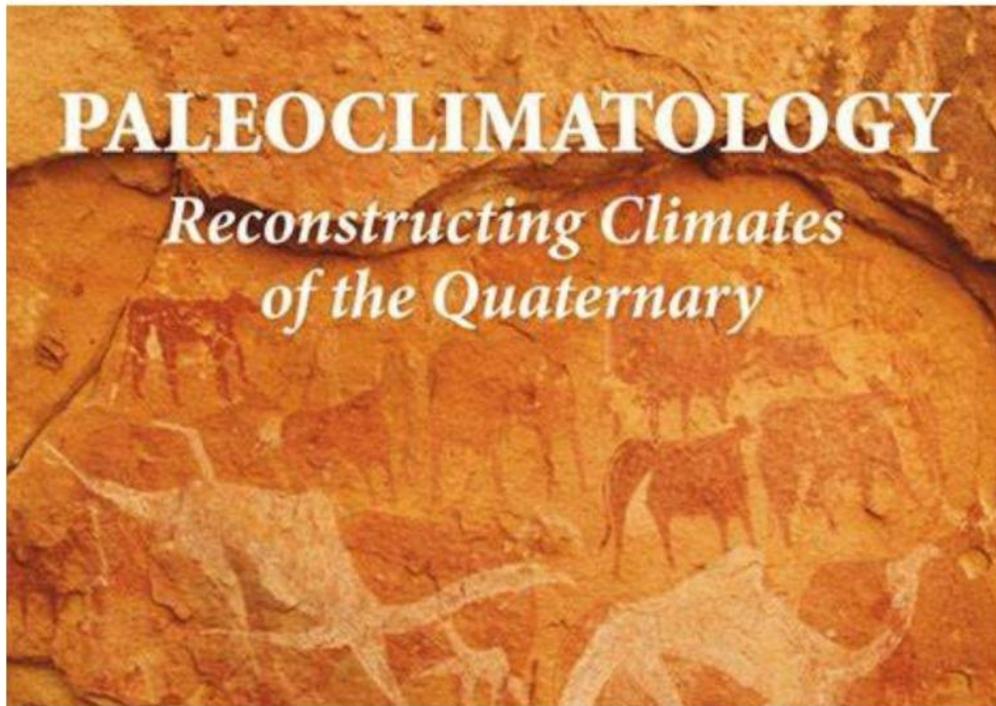
PALEOCLIMATOLOGY
Reconstructing Climates of the Quaternary

climate.news Do you know how past climates are being studied? Paleoclimatology, a study of changes in climate throughout Earth's history, uses evidence found in tree rings, ocean sediment, coral reefs, and layers of sedimentary rocks to do so. #NASA #Climate #Research

---

Like-control-5

◯ Like

Control-post-6

climate.news

climate.news Climate is measured by observing air, land, and ocean. Surface air temperature, typically taken about 2 meters above the ground, is measured with thermometers shielded from sunlight. The common type is the liquid-in-glass thermometer, while more precise ones, like the air temperature sensor shown on the photo, check electricity through metal samples. #Climate #ObservingAir #ClimateAndWeatherMeasurment

---

Like-control-6

○ Like

Control-post-7

climate.news Rain gauges are the most common instrument used to measure rainfall. A rain gauge is an open-at-the-top container that is calibrated to measure the depth of liquid caught. In the United States, the depth of precipitation is reported in inches. Satellite instruments can also detect and estimate precipitation amounts. #RainfallMeasuring #Climate

Like-control-7

○ Like

Control-post-8

climate.news

climate.news Snow cover is the amount of snow on the ground, usually shown as a percentage. It's important in the Northern Hemisphere because it reflects a lot of sunlight, impacting the climate. Snow is much more reflective than bare ground, so when it melts in spring, the ground warms rapidly. Satellites and ground instruments, like snow pillows shown on the photo, measure snow cover, depth, and water content.
#Climate #SnowPillows #ClimateAndWeatherMeasurment

Like-control-8

○ Like

Control-post-9

climate.news Temperature (SST) is defined as the skin temperature (top 2 mm) of the ocean. Historically, ships measured sea surface temperature directly, and later, buoys were fitted with thermometers to check the temperature of surface waters. Instruments on satellites, like the one shown on the photo, now remotely measure SST for the whole world every day. #Satelites #OceanTemperature #ClimateAndWeatherMeasurment

Like-control-9

○ Like

Control-post-10

climate.news ⋮
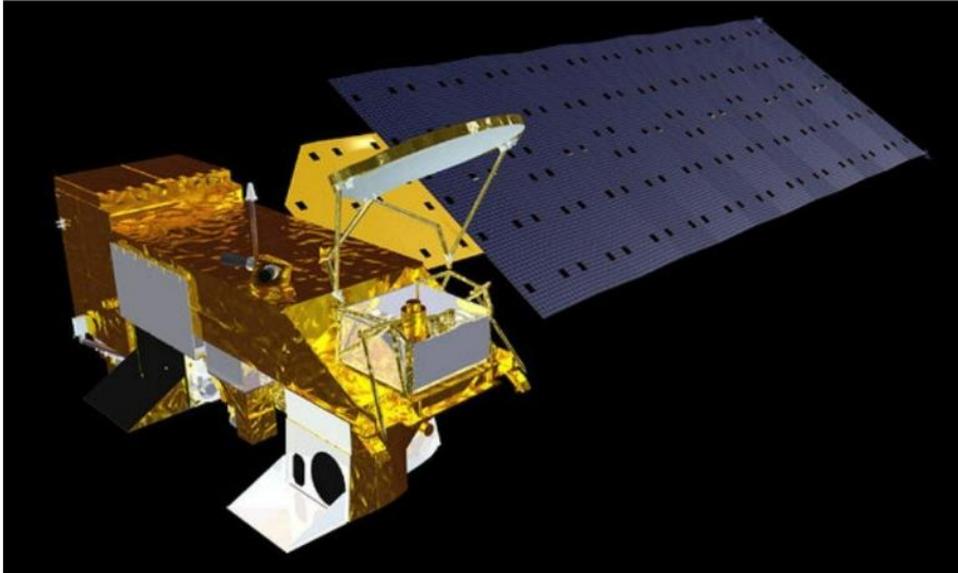
climate.news The color of the ocean can be strongly influenced by the presence of microscopic algae (phytoplankton) that contain chlorophyll. When populations of phytoplankton have the right combination of nutrients, sunlight, and water temperatures, they can explode into "blooms" large enough to be visible from space. Additionally, phenomena such as suspended sediments and solutions of dissolved natural materials can affect ocean color. Instruments on satellites measure ocean color from space. #OceanColor #ClimateAndWeatherMeasurment

Like-control-10

◯ Like

End of Block: Control-condition

Start of Block: Content-type-block

Content-type Which type of content did you scroll through?

◯ Hopeful climate change content

◯ Fearful climate change content

◯ Both hopeful and fearful climate change content

◯ Content did not specifically focus on climate change or elicit any specific emotions / It was educational content about climate

End of Block: Content-type-block

Start of Block: Intentions-future-block

Intentions-future Please indicate how often you plan to take each of the following actions IN THE FUTURE.

	Never	Occasionally	Often	Always
Turn off lights you're not using	◯	◯	◯	◯
Drive economically (e.g., braking or accelerating gently)	◯	◯	◯	◯
Walk, cycle, or take public transport for short journeys (i.e., trips of less than 5 kilometers)	◯	◯	◯	◯
Use an alternative to traveling (e.g., shopping online)	◯	◯	◯	◯
Share a car journey with someone else	◯	◯	◯	◯
Cut down on the amount you fly	◯	◯	◯	◯

Buy environmentally-friendly products	○	○	○	○
Eat food which is organic, locally-grown or in season	○	○	○	○
Avoid eating meat	○	○	○	○
Buy products with less packaging	○	○	○	○
Recycle	○	○	○	○
Reuse or repair items instead of throwing them away	○	○	○	○
Compost your kitchen waste	○	○	○	○
Save water by taking shorter showers	○	○	○	○
Turn off the tap while you brush your teeth	○	○	○	○
Write to your MP (Member of Parliament) about an environmental issue	○	○	○	○
Take part in a protest about an environmental issue	○	○	○	○

End of Block: Intentions-future-block

Start of Block: Weekly-social-media-usage-block

Days In the last 7 days, how many days did you use social media?

○ Never

○ 1 day

○ 2 days

○ 3 days

○ 4 days

○ 5 days

○ 6 days

○ 7 days

Hours In the last 30 days, on average, how many hours per day have you spent on social media?

○ I don't use

○ Less then an hour

○ 1 hour

○ 2-3 hours

○ 4-5 hours

○ More than 6 hours

Channels Which social media channels out of the mentioned ones do you use?

○ Instagram

○ Facebook

○ Twitter / X

○ TikTok

○ LinkedIn

○ None of the above

End of Block: Weekly-social-media-usage-block

Start of Block: Doomscrolling-scale-block

Doomscrolling-scale Please indicate how often the following statements apply to you by selecting the appropriate option from the scale above.

	Strongly disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
I feel an urge to seek bad news on social media, more and more often.	○	○	○	○	○
I lose track of time when I read bad news on social media.	○	○	○	○	○
I constantly refresh my newsfeeds to see if something bad happened.	○	○	○	○	○
I stay up late at night trying to find more negative news.	○	○	○	○	○
Reading negative news on social media is more of a habit now.	○	○	○	○	○
When I am online, I feel tense as if something bad is going to happen soon.	○	○	○	○	○
I constantly feel panicked while scrolling on my device.	○	○	○	○	○
I unconsciously check my newsfeeds for bad news.	○	○	○	○	○
Even if my newsfeed says I am all caught up, I just keep scrolling for negative news.	○	○	○	○	○

I find myself continuously browsing negative news.	◯	◯	◯	◯	◯
I check social media in the morning to see what bad things have happened.	◯	◯	◯	◯	◯
I feel like I am addicted to negative news.	◯	◯	◯	◯	◯
My social media searches probably make my newsfeeds more negative.	◯	◯	◯	◯	◯
I am terrified by what I see on social media but I cannot look away.	◯	◯	◯	◯	◯
It's difficult to stop reading negative news on social media	◯	◯	◯	◯	◯

Thank you for your time spent on this experiment.
Your response has been recorded.

Q41 Timing
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End of Block: Thank-you-block

Start of Block: Cup-choice-block

Cup-choice What cup did participant select?

○ Sustainable option (glass cup)

○ Non-sustainable option (plastic cup)

○ Did not select any

End of Block: Cup-choice-block

End of Survey

We thank you for your time spent taking this survey.

Your response has been recorded.

Appendix C

**List of tools used during the work**

During the preparation of this work, the author used ChatGPT to check the grammar and improve the flow of sentences. The author also used ChatGPT during the analysis phase to explain errors that occurred and to find solutions to them. After using this tool, the author reviewed and edited the content as needed, and takes full responsibility for the final content of the work.

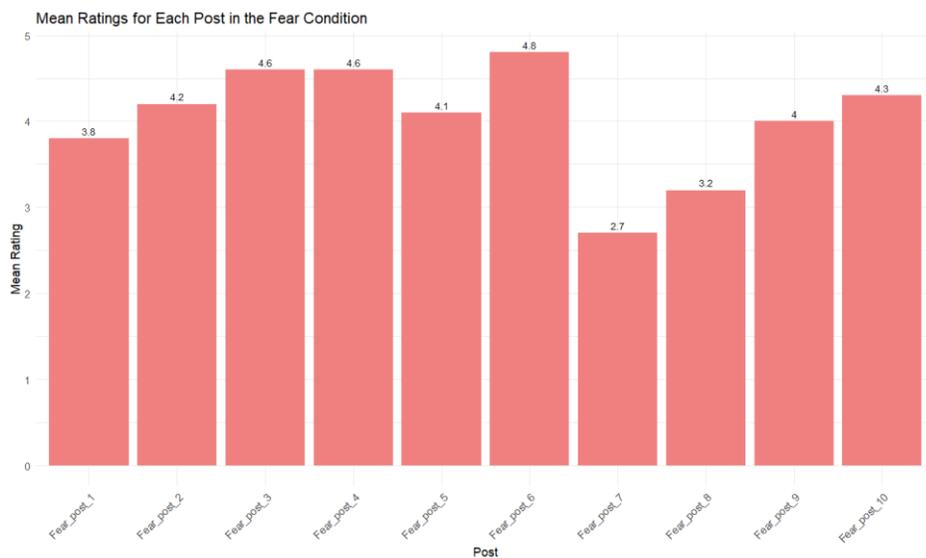# Appendix C

Preliminary Research Means Graphs

Figure 1

Bar chart showing mean per post for hope condition pretest

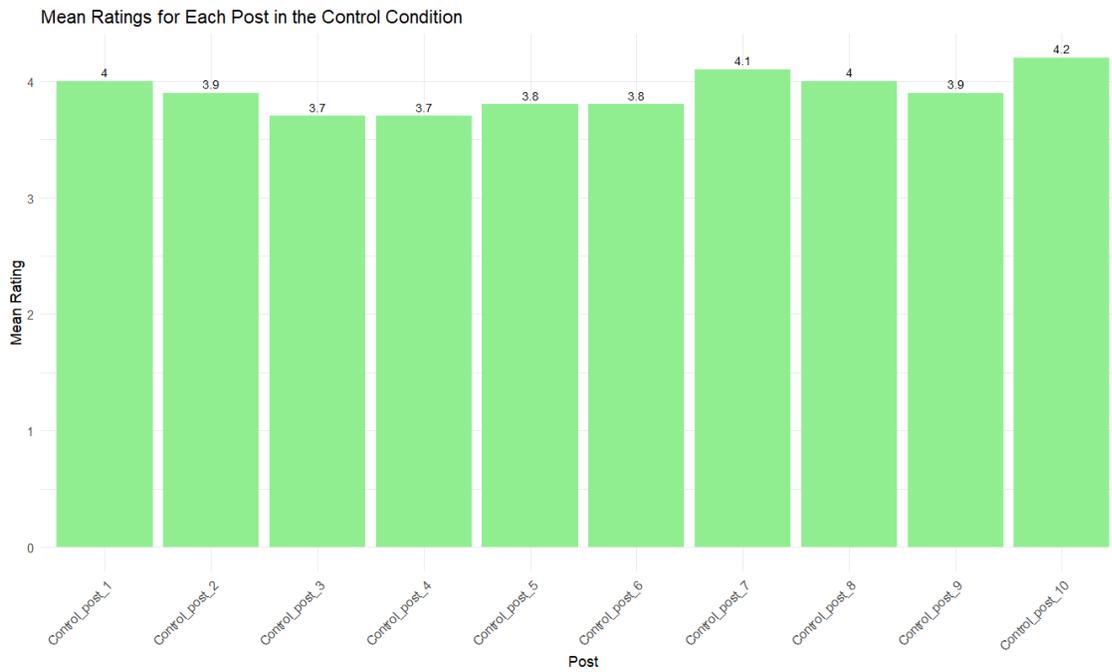Mean Ratings for Each Post in the Hope Condition
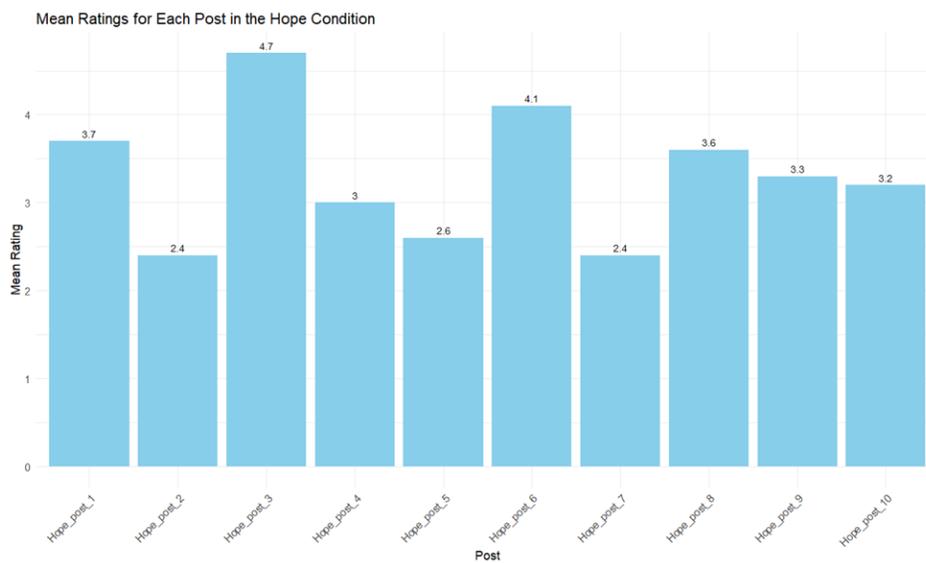
Note. N = 10

Figure 2

Bar chart showing mean per post for fear condition pretest

Mean Ratings for Each Post in the Fear Condition

Note. N = 10

Figure 3

Bar chart showing mean per post for control condition pretest

Mean Ratings for Each Post in the Control Condition

Note. N = 10

Appendix D

Factor Analysis for Sustainable Intentions

Table 3

Factor analysis results for future behavioral intentions scale

Factor analysis		
Scale item	Factor	
	1	2
Intentions_future_1 Turn off lights you're not using	-0.14	**0.70**
Intentions_future_2 Drive economically (e.g., braking or accelerating gently)	0.17	**0.56**
Intentions_future_3 Walk, cycle, or take public transport for short journeys (i.e., trips of less than 5 kilometers)	0.27	**0.38**
Intentions_future_4 Use an alternative to traveling (e.g., shopping online)	0.12	**0.52**
Intentions_future_5 Share a car journey with someone else	0.17	**0.59**
Intentions_future_6 Cut down on the amount you fly	**0.39**	**0.48**
Intentions_future_7 Buy environmentally-friendly products	**0.73**	
Intentions_future_8 Eat food which is organic, locally-grown or in season	**0.71**	
Intentions_future_9 Avoid eating meat	**0.63**	
Intentions_future_10 Buy products with less packaging	**0.57**	0.15
Intentions_future_11 Recycle	**0.42**	0.24
Intentions_future_12 Reuse or repair items instead of throwing them away	0.12	**0.62**
Intentions_future_13 Compost your kitchen waste	**0.59**	0.16
Intentions_future_14 Save water by taking shorter showers	**0.51**	**0.40**
Intentions_future_15 Turn off the tap while you brush your teeth	0.20	
Intentions_future_16 Write to your MP (Member of Parliament) about an environmental issue	**0.66**	0.19
Intentions_future_17 Take part in a protest about an environmental issue	**0.73**	0.26
Explained variance:	22.9%	15.0%
Eigenvalue:	3.887	2.556

Note. N = 120. Factor loadings above .30 are in bold. Items adopted from "Green identity, green living? The role of pro-environmental self-identity in determining consistency across diverse

pro-environmental behaviours." by Whitmarsh, L., & O'Neill, S. (2010)., *Journal of Environmental Psychology*, *30*(3), 305–314. https://doi.org/10.1016/j.jenvp.2010.01.003

Appendix E

List of Tools Used During the Work

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