Affective Framing of Environmental News Headlines Influences Engagement, Donations, and Memory

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Abstract

Negativity motivates people to read and share news, but can also harm mental health and discourage action. We tested an alternate route to engagement—evoking positive emotions by emphasizing action to address a problem. In two experiments, we adapted environmental news headlines to feature different aspects of each story, emphasizing *Crisis* or *Action*. Both Crisis and Action framing (and negative and positive emotions, respectively) motivated reading and sharing, relative to the unaltered headlines. Crucially, consistent with theoretical predictions, we identified a trade-off: Crisis framing had the strongest effects on immediate engagement (increasing sharing and charitable donations), but Action framing enhanced future memory for news content. In a third study, we computationally classified content in >25,000 news articles on social media; Action and Crisis framing were both associated with increased engagement. Overall, we demonstrate that the affective framing of news modulates reading, sharing, donations, and memory in laboratory and real-world settings.

Emotional Framing of News Headlines Influences Engagement, Donations, and Memory

"If it bleeds, it leads." In news reporting, this prevalent adage describes how negative stories captivate audiences (Parks, 2019; Pooley, 1989). Consistent with this idea, negative information captures attention and is more likely to be read and shared (Robertson et al., 2023; Rozin & Royzman, 2001; Soroka et al., 2019; Stieglitz & Dang-Xuan, 2013). However, negative messaging can harm mental health, distort memory, and discourage action to address a problem (de Hoog & Verboon, 2020; Monds et al., 2016; Nekliudov et al., 2020; Vlasceanu et al., 2024). We investigated the diverse effects of negative framing on behavior and tested an alternate strategy for increasing engagement—evoking positive emotions by describing how people are taking action to *address* a problem. In two experiments and a social media field study, we demonstrate that affective framing modulates intentions to read and share news, charitable donations, and memory for news content.

Across domains, humans are drawn to negative information (Baumeister et al., 2001). Negative stimuli capture attention, evoke physiological arousal, dominate first impressions, and bias judgments (Rozin & Royzman, 2001; Soroka et al., 2019). News that evokes strong negative emotions (e.g., fear, disgust, moral outrage) is more likely to be shared online (Crockett, 2017; Vosoughi et al., 2018), contributing to the spread of harmful misinformation (Vosoughi et al., 2018). Emotionally-charged posts on social media are also shared broadly and rapidly (Brady et al., 2017; Chuai & Zhao, 2022; Stieglitz & Dang-Xuan, 2013). One study leveraged data from *Upworthy.com*, an online news outlet that pilot-tests alternate headlines (Robertson et al., 2023). Headlines that included more negative words generated more clicks, whereas positive words *decreased* clicks.

Although negative news is engaging, it may also harm mental health and distort memory. Consuming negative news is associated with negative mood states (de Hoog & Verboon, 2020; Knobloch-Westerwick, 2021; Shaikh et al., 2022; Soroka et al., 2019) and poor mental health outcomes, including posttraumatic stress, anxiety, and depression (Pfefferbaum et al., 2014). During the COVID-19 pandemic, negative news consumption was linked to increased distress, worry, and anxiety (Nekliudov et al., 2020; Riehm et al., 2019; Stainback et al., 2020). Negative stimuli are more memorable (Bowen et al., 2018; Kensinger, 2004, 2009), but negative emotions can also impair or distort memory, causing forgetting of details (Fawcett et al., 2013), overgeneralization (Brown et al., 2013; Oyarzún & Packard, 2012), and vulnerability to misinformation (Monds et al., 2016; Porter et al., 2014).

Negative messaging can also discourage sustained action to address a problem, a concern for societal challenges like climate change. Climate change poses an urgent crisis for our planet and society; increasing the spread and impact of credible information about climate change is important for motivating action (Maibach et al., 2023; Whitmarsh et al., 2021), reducing pluralistic ignorance (Geiger & Swim, 2016; Geiger et al., 2024), and counteracting misinformation (Mashamaite, 2023; Treen et al., 2020). Messages about climate change that emphasize crisis can increase fear and decrease hope, efficacy, and perceived news credibility (Feldman & Hart, 2016, 2018, 2021; Hart & Feldman, 2016). In a recent global mega-study, negative messages about climate change motivated information sharing, but also backfired by discouraging action to address climate change (Vlasceanu et al., 2024). In the domain of climate communication, an ongoing theoretical debate questions whether communicators should evoke positive or negative emotions; current evidence is inconclusive (Chapman et al., 2017).

Overall, negative news is engaging, but can have harmful effects for individuals and society. This poses a challenge for journalists, who are financially incentivized to maximize engagement. To counteract negative news, the *solutions journalism* movement aims to increase rigorous, balanced, and impactful reporting by highlighting *what people are doing* to address a problem (*Solutions Journalism Network*, 2024; Thier & Lin, 2022). In support of this practice, prior studies have shown that emphasizing action and efficacy in messages about climate change increases hope and policy support (Feldman & Hart, 2016, 2018; Hart & Feldman, 2016), news stories that evokes strong positive emotions are more likely to go viral online (Berger & Milkman, 2012), and curiosity and positive emotions can motivate information seeking (Hsiung et al., 2023; Litman, 2005).

Taken together, these diverse findings reveal a theoretical gap and a societal challenge. Negative news can have both beneficial and harmful effects; the effects of positive framing are less clear and inconsistent across studies. The *Imperative/Interrogative Theory of Motivation* offers a framework (informed by neuromodulatory systems that shape cognition) for understanding the complex effects of affect on engagement and memory (Chiew & Adcock, 2019; Dickerson & Adcock, 2018; Sinclair et al., 2023). According to this framework, imperative motivation—characterized by urgency, threat, or fear—focuses attention to drive immediate goal-relevant behavior, but impairs memory for associated details. In contrast, interrogative motivation—characterized by future goals, reward, or curiosity—supports exploratory information seeking and elaborated memory formation.

Drawing on this theoretical framework, we explored how framing headlines to emphasize *crisis and urgency* (evoking imperative motivation and negative emotions) or *progress toward future goals* (evoking interrogative motivation and positive emotions) influenced reading,

sharing, donations, and memory. We predicted that both of these framing strategies would motivate people to read and share information (e.g., by evoking strong emotions, capturing attention, or motivating exploration). However, we also predicted a trade-off: We expected that emphasizing crisis and urgency (imperative motivation) would have stronger effects on immediate goal-relevant behaviors like sharing and donating, whereas emphasizing progress toward future goals (interrogative motivation) would enhance long-term memory for news content. We tested these predictions in two experiments (one pre-registered) and a large-scale analysis of real-world news engagement on social media.

Study 1

Study 1 Methods

Please refer to the Supplemental Material for additional details about the methodology.

Participants

We recruited participants from Prolific, an online platform for paid study participation. We chose Prolific for recruitment because the platform offers ease and convenience, greater diversity than student samples, and high data quality (relative to other online recruitment options) (Douglas et al., 2023). Inclusion criteria were as follows: Fluent in English, residing in the United States, normal or corrected-to-normal vision, prior completion of 50+ Prolific tasks, and prior task approval rate of at least 90%. Participants were paid $2 for a task that took approximately 10 minutes to complete. The study was approved by the Institutional Review Board at the University of Pennsylvania (protocol #842732). Participants provided informed consent at the start of the task.

We excluded 2 participants who demonstrated high response invariance (responding with "0" to all rating scales for ≥10 of 11 articles). We also excluded 8 participants who reported (in a survey at the end of the study) denying the existence of anthropogenic climate change, because we expected that climate change deniers may have atypical responses to environmental news. The final sample included 292 participants.

Stimuli

We sourced 11 news articles from the Associated Press and the Tampa Bay Times (outlets selected due to a collaboration with journalists). All articles pertained to climate change or environmental issues (e.g., hurricanes, a chemical spill, rescuing coral reefs). We created 11 alternate versions of each article, enabling a within-subjects design with a control condition (the original version of the article, as published) and experimental conditions that manipulated multiple variables. The stimuli are available in our OSF project folder (https://osf.io/976yc/).

We were primarily interested in how *message framing* would influence engagement and emotional responses. For each article, we created alternate headlines that emphasized *Crisis* (disaster, urgency, and negative emotions) or *Action* (progress, innovation, or positive emotions). Crisis framing emphasizes the scope and gravity of a problem, whereas Action framing emphasizes what people are doing to *address* a problem or improve a situation. We paired each headline with a lede sentence adapted from content within the published article. Importantly, these lede sentences were only edited for clarity and length. All news articles in our stimulus set contained elements of crisis and action framing—we tested the effects of choosing to foreground *different aspects of the same story.* In the Control condition, headline/lede text was unaltered (as originally published). We also explored whether the images paired with the headlines would influence engagement and affect; these exploratory analyses are not reported here.

Procedure

The task was administered with Qualtrics software. Each participants viewed all 11 articles; each article was randomly assigned to a condition (combining a message framing condition with an image condition), and the order of article presentation was randomized. For each article, participants viewed a headline and associated lede sentence, paired with one of the five possible images sourced from the originally published article, or no image (see Supplemental Material, *Study 1: Supplemental Methods*). Below the article, participants rated their agreement with several statements, using a sliding scale ranging from 0 (strongly disagree) to 100 (strongly agree) (Figure 1B). Participants rated their intentions to read the article ("I would read this article"), share the article broadly ("I would share this article by posting on social media"), and share the article narrowly ("I would share this article directly with someone I know"). Participants also rated the extent to which the article elicited positive affect ("This article makes me feel hopeful, determined, or inspired") and negative affect ("This article makes me feel hopeless, anxious, or upset").

Statistical Analysis

For all studies, analyses were conducted with R (version 4.4.1), implemented in RStudio (version 2024.04.2). We used the packages *lme4* (Bates et al., 2014) and *lmerTest* (Kuznetsova et al., 2017) for analysis. Other packages used for preprocessing and visualization included *tidyr* (Wickham, 2021), *dplyr* (Wickham et al., 2021), *ggplot2* (Wickham, 2016), and *sjPlot* (Lüdecke, 2021). Data and code necessary to reproduce results from all studies are provided in a permanent public repository (https://osf.io/976yc/).

We used linear mixed-effects regression models to predict continuous ratings as outcome measures (e.g., reading intentions, sharing intentions, positive emotions). All models included

random intercepts to account for variance by participant and by article. For analyses investigating the effects of message framing on engagement and affect, we conducted planned pairwise comparisons to compare the three framing conditions (Action, Crisis, and Control). We also explored whether effects differed across image conditions, and whether message framing interacted with image variables; results are reported in the Supplemental Material (Study 1: Supplemental Results; Supplemental Tables 2-6).

A Message Framing

Control Framing (As Published)

Climate migration: Alaska village resists despite threats

The Alaska Native village of Shishmaref is located on a sinking barrier island in the Chukchi Sea near the Bering Strait, where it is constantly threatened by the effects of climate change.

Crisis Framing

Climate change threatens to destroy Alaska village

Homes are perilously close to falling into the ocean, and headlines warn that this town is on the verge of disappearing.

Action Framing

Alaska villagers adapt to climate change threats

There's still life happening despite all the weight and the burden that climate change can cast upon this community.

B Rating Phase

Climate change threatens to destroy Alaska village

Homes are perilously close to falling into the ocean, and headlines warn that this town is on the verge of disappearing.

- Reading intention
- Broadcast sharing intention
- Narrowcast sharing intention
- Positive affect
- Negative affect
- Perceived self-relevance
- Perceived social-relevance

C Donation Phase (Study 2)

Climate change threatens to destroy Alaska village

Homes are perilously close to falling into the ocean, and headlines warn that this town is on the verge of disappearing.

Donations will help support Alaskan villagers and nature.

Participants were given an endowment that they could keep as a bonus payment or optionally donate to charities related to each article.

Donation: (% of funds)

0% 30 100%

D Next-Day Memory Test (Study 2)

Topic Recognition

In Part 1 of this study, did you see an article about **an Alaska village coping with climate change threats?**

Text Recognition

Which of these headlines did you see in Part 1 of the study?

Climate migration: Alaska village resists despite threats
The Alaska Native village of Shishmaref...

Climate change threatens to destroy Alaska village
Homes are perilously close to falling...

Alaska villagers adapt to climate change threats
There's still life happening despite...

Image Recognition

Which of these images was associated with the article?

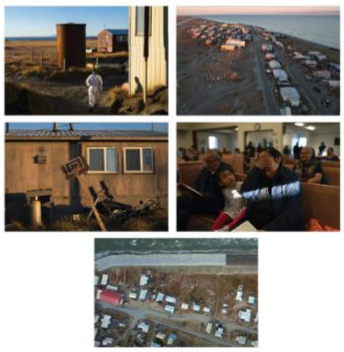

Figure 1. Overview of Paradigm. A) We adapted a set of news headlines about climate change to compare the original headlines (Control) with alternate versions that emphasized Crisis or Action. The stimuli visualized in this figure were adapted from an article published by the Associated Press, written by Luis Andre Henao (Henao, 2022). B) For each article, participants viewed an image paired with one version of the article text. Image variants are described in the Supplemental Material. Participants rated reading intentions, sharing intentions, positive and negative affect, and perceived self- and social-relevance for each article. C) In addition, in Study 2, after completing all article ratings, participants received a $2 endowment and had the option to donate to charity causes associated with each of the articles. Alternatively, participants could choose to keep the endowment as a bonus payment. D) In Study 2, participants also completed a surprise memory test after a one-day delay. We assessed recognition memory for the general topics of the articles (broadly applicable to all article variants; old/new responses), headline/lede text (3-alternative forced choice), and images (5-alternative forced choice).

Study 1 Results

Positive and Negative Affect Are Associated with Intentions to Read and Share News

First, we investigated whether affect predicted news engagement, operationalized as reading and sharing intentions. To test whether positive and negative affect had similar or different effects, we included both sets of ratings in a model under a combined *affect* variable (continuous measure ranging from 0-100), with a *valence* variable to distinguish between positive and negative affect ratings. Using linear mixed effects regression, we predicted reading intentions from affect and the interaction between affect and valence. There was a significant main effect of affect, indicating that stronger affect predicted greater reading intentions ($\beta = 0.12$, 95% CI [0.10, 0.14], $t = 12.46$, $p < 0.0001$) (Figure 2A). Affect did not interact with valence ($\beta = -0.01$, 95% CI [-0.03, 0.01], $t = -0.86$, $p = 0.389$). Simple slopes confirmed that both positive affect ($\beta = 0.12$, 95% CI [0.09, 0.15], $t = 9.12$, $p < 0.0001$) and negative affect ($\beta = 0.11$, 95% CI [0.08, 0.13], $t = 8.31$, $p < 0.0001$) were positively associated with reading intentions.

In separate models, we then repeated this analysis to predict broadcast and narrowcast sharing intentions (Figure 2B, 2C). Affect ratings predicted both broadcast sharing ($\beta = 0.06$, 95% CI [0.05, 0.08], $t = 7.87$, $p < 0.0001$) and narrowcast sharing intentions ($\beta = 0.07$, 95% CI

[0.05, 0.09], $t = 7.53$, $p < 0.0001$). There were no interactions with valence for either broadcast ($\beta = -0.005$, 95% CI [-0.02, 0.01], $t = -0.64$, $p = 0.521$) or narrowcast sharing ($\beta = -0.02$, 95% CI [-0.03, 0.002], $t = -1.75$, $p = 0.081$). Simple slopes confirmed that positive affect and negative affect had similar effects on both broadcast sharing (positive: $\beta = 0.07$, 95% CI [0.05, 0.09], $t = 6.03$, $p < 0.0001$; negative: $\beta = 0.06$, 95% CI [0.04, 0.08], $t = 5.38$, $p < 0.0001$) and narrowcast sharing (positive: $\beta = 0.09$, 95% CI [0.06, 0.11], $t = 6.53$, $p < 0.0001$; negative: $\beta = 0.05$, 95% CI [0.03, 0.08], $t = 4.35$, $p < 0.0001$).

Overall, we found that both positive and negative emotions were strongly associated with increased intentions to read and share news headlines.

Crisis and Action Framing Influence Affect and Engagement

We expected that message framing would influence affect. In separate linear mixed-effects regression models, we compared positive and negative affect ratings across framing conditions (Figure 2D, 2E). We conducted planned pairwise comparisons among the three message framing conditions (Action, Crisis, and Control). Note that for these pairwise comparisons (obtained with the *emmeans* package in R, 65), we report z-statistics rather than t-statistics; this approach is recommended for reducing computational demands associated with mixed-effects models.

Relative to the Control condition, Action framing strongly increased positive affect ($\beta = 0.60$, 95% CI [0.52, 0.69], $z = 13.36$, $p < 0.0001$) and decreased negative affect ($\beta = -0.22$, 95% CI [-0.31, -0.14], $z = -5.37$, $p < 0.0001$). Conversely, Crisis framing strongly decreased positive affect ($\beta = -0.40$, 95% CI [-0.49, -0.31], $z = -8.82$, $p < 0.0001$) and increased negative affect ($\beta = 0.58$, 95% CI [0.49, 0.66], $z = 13.86$, $p < 0.0001$). Accordingly, positive affect was substantially greater in the Action condition relative to the Crisis condition ($\beta = 1.00$, 95% CI [0.95, 1.06], $z =$

38.47, $p < 0.0001$), and negative affect was greater in the crisis condition (β = 0.80, 95% CI [0.75, 0.85], $z = 33.26$, $p < 0.0001$). In supplemental analyses, we also demonstrated that both Action and Crisis framing increased the perceived self-relevance and social-relevance of news headlines relative to the control condition (Supplemental Material, *Study 1: Supplemental Results*).

We then investigated whether message framing influenced engagement. Using linear mixed-effects regression, we predicted *reading intentions* (continuous variable ranging from 0-100) from *message framing* (action, crisis, or control). Crisis and Action framing both significantly increased reading intentions relative to the Control condition (Crisis > Control: β = 0.15, 95% CI [0.10, 0.35], $z = 3.52$, $p = 0.0004$; Action > Control: β = 0.08, 95% CI [0.01, 0.25], $z = 1.97$, $p = 0.0486$) (Figure 3A). Reading intentions were also higher in the Crisis condition relative to the Action condition (β = 0.07, 95% CI [0.03, 0.17], $z = 2.67$, $p = 0.008$).

Next, we repeated this analysis to investigate intentions to share the news articles broadly on social media ("broadcast" sharing intentions). As with reading intentions, both Crisis framing and Action framing increased broadcast intentions, with the greatest intentions in the Crisis condition (Crisis > Control: β = 0.16, 95% CI [0.09, 0.22], $z = 4.46$, $p < 0.0001$; Action > Control: β = 0.08, 95% CI [0.01, 0.15], $z = 2.23$, $p = 0.026$; Crisis > Action: β = 0.08, 95% CI [0.04, 0.12], $z = 3.85$, $p = 0.0001$) (Figure 3B). We then predicted intentions to share news articles directly with a known other, such as by email or direct message ("narrowcast" sharing intentions). Crisis framing increased narrowcast sharing intentions, but Action framing did not (Crisis > Control: β = 0.10, 95% CI [0.01, 0.17], $z = 2.29$, $p = 0.022$; Action > Control: β = 0.02, 95% CI [-0.06, 0.10], $z = 0.64$, $p = 0.641$; Crisis > Action: β = 0.07, 95% CI [0.03, 0.12], $z = 3.16$, $p = 0.002$) (Figure 3C).

In sum, we found that Crisis and Action framing strategies substantially modulated emotions (increasing negative and positive affect, respectively). Both framing strategies also increased intentions to read articles and share articles broadly on social media, relative to the unaltered versions of the headlines. However, Crisis framing had the strongest effects on engagement overall, particularly for narrowcast sharing (directly with a known other).

Affect Mediates the Effects of Message Framing on Engagement

As described above, we found that Crisis and Action framing increased engagement (*a* path) and also modulated affect (*b* path). Both positive and negative affect predicted increased engagement (*c* path). Therefore, we conducted mixed-effects mediation analyses to test whether the effects of message framing on reading and sharing intentions could be explained by affect. For these mediation analyses, we grouped together the action and crisis framing conditions and compared this combined "treatment" condition with the control condition. As positive and negative affect had comparable effects on reading and sharing intentions, we calculated *total affect* as the sum of positive and negative affect ratings. Total affect mediated 81.0% of the total effect of framing on reading intentions (indirect effect = 0.10, 95% CI [0.07, 0.14], $p < 0.0001$). Similarly, total affect mediated 92.0% the total effect of framing on narrowcast sharing intentions (indirect effect = 0.06, 95% CI [0.04, 0.08], $p < 0.0001$) and mediated 46.5% of the total effect of framing on broadcast sharing intentions (indirect effect = 0.06, 95% CI [0.04, 0.08], $p < 0.0001$). Detailed mediation results are reported in Supplemental Table 1.

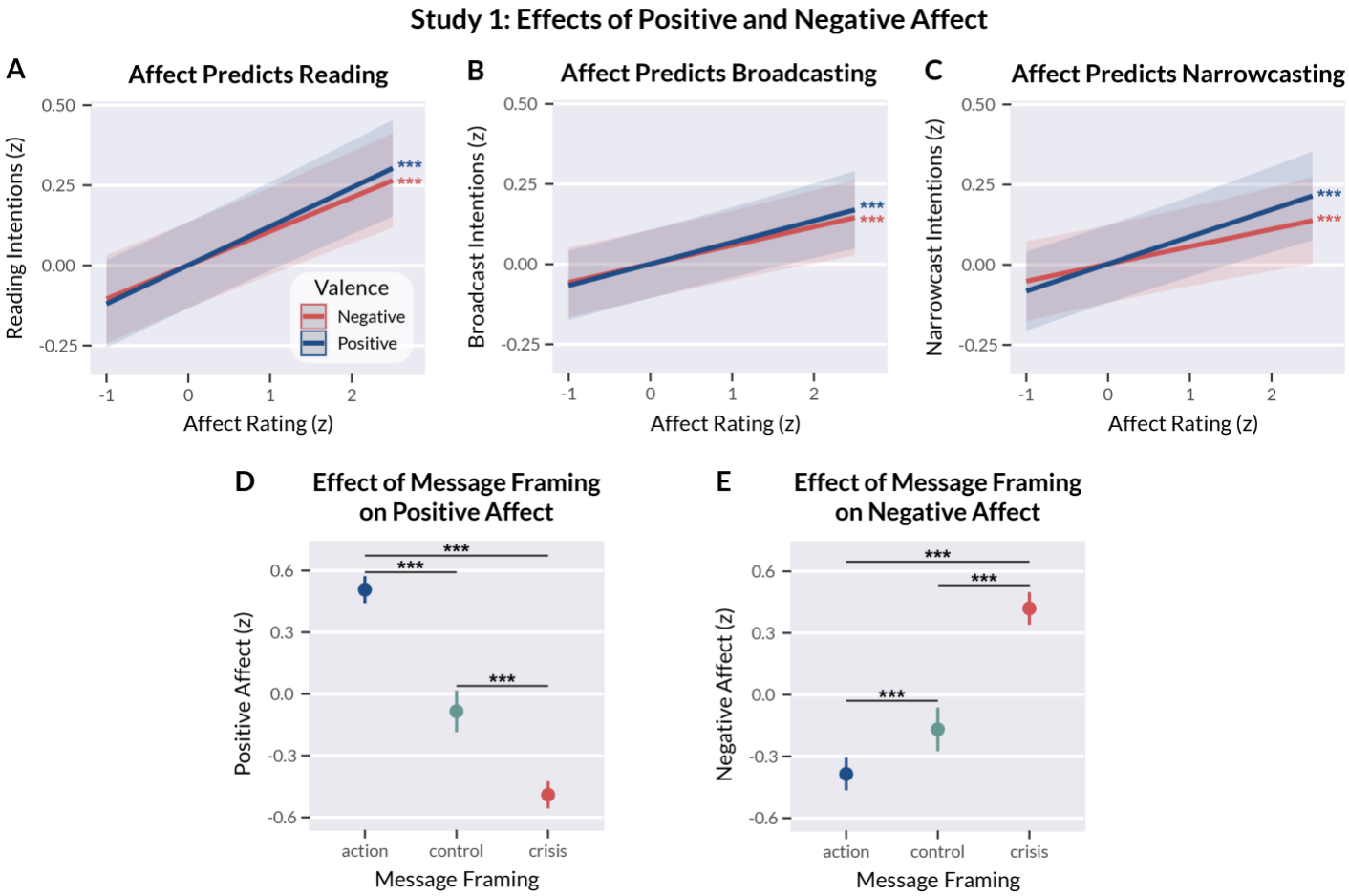

Figure 2. Study 1: Effects of Positive and Negative Affect. Positive and negative affect ratings had equally strong positive relationships with reading intentions (A), broadcast sharing intentions (B), and narrowcast sharing intentions (C). Action framing strongly increased positive affect and decreased negative affect, whereas Crisis framing had the inverse effects (D-E). Plots depict estimates obtained from linear mixed-effects regression models, controlling for by-participant and by-article variance. Error bars and shaded bands indicate 95% confidence intervals. All significance tests were two-tailed. * $p<0.05$, ** $p<0.01$, *** $p<0.001$, n.s.=not significant

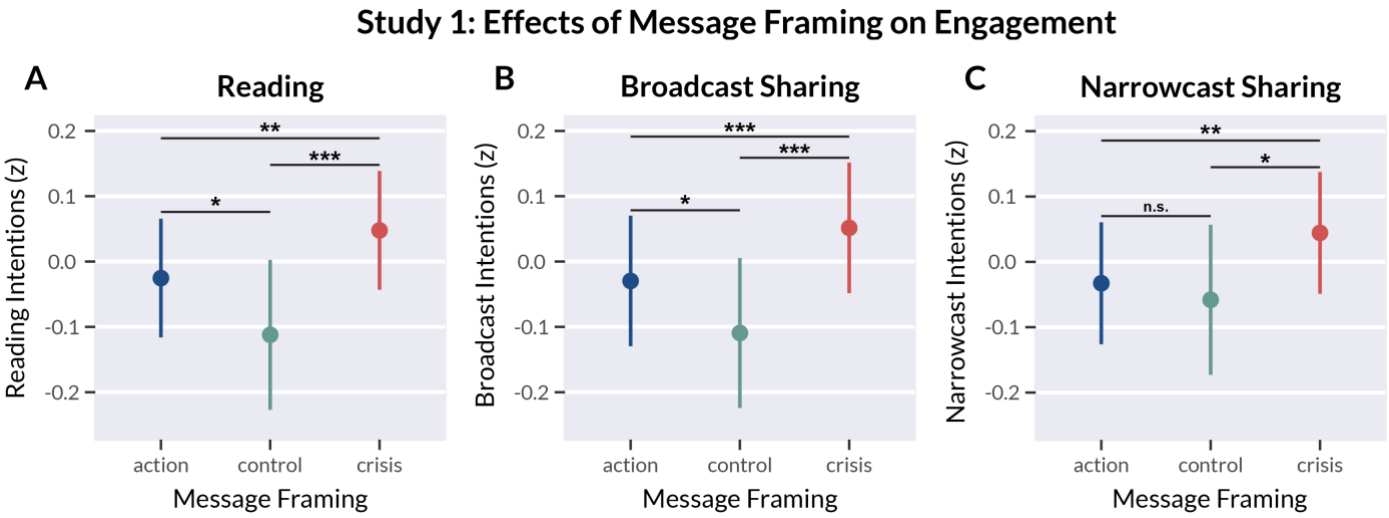

Figure 3. Study 1: Effects of Message Framing on Engagement. Both Action and Crisis framing increased intentions to read the articles (A) and share the articles broadly on social media (B), relative to the Control condition (unaltered articles, as originally published). Crisis framing, but not Action framing, increased intentions to share the articles directly with a close other (C). Plots depict estimates obtained from linear mixed-effects regression models, controlling for by-participant and by-article variance. Error bars indicate 95% confidence intervals. All significance tests were two-tailed. * $p<0.05$, ** $p<0.01$, *** $p<0.001$, n.s.=not significant.

Study 2

In Study 1, we found that Action and Crisis framing strongly modulated affect; positive and negative affect were both positively related to reading and sharing intentions. Both Action and Crisis framing increased reading and sharing intentions relative to the unaltered versions of the headlines (as originally published), although Crisis framing led to the greatest engagement overall. In Study 2, we tested preregistered predictions based on Study 1 (https://doi.org/10.17605/OSF.IO/FB64D) and extended our paradigm by assessing charitable donations and memory for news content.

Study 2 Methods

Please refer to the Supplemental Material (*Study 2: Supplemental Methods*) for additional methodological details.

Participants

We recruited participants from Prolific with the same inclusion criteria as Study 1. Participants completed a two-session study that took place over two consecutive days. Session 1 and Session 2 each took ~13 minutes to complete; participants were compensated with $2.60 per session. We excluded participants for the following preregistered reasons: failed attention checks (n=26), provided the same response to all measures for 11+ articles (n=8), climate change denial (n=5), or self-reported dishonesty (n=1). Among these participants, 5 met multiple criteria for exclusion. The final Session 1 sample included 395 participants; 338 (85.6%) returned for Session 2.

Deviations from Preregistration

Immediately after Session 1 data collection, we conducted basic quality checks to determine which participants would be invited to return for Session 2. As the exclusion rate (e.g.,

due to failed attention checks) was higher than anticipated, we recruited an additional 30 participants to ensure that we would meet our target sample size. In the preregistration, we stated that in models assessing memory outcomes, we would include a covariate of no interest for the order of article presentation during Session 1. Due to a technical error, article order information was not saved, so we were not able to include this covariate. Notably, as article order and conditions were fully randomized, trial order is not a confounding variable.

Procedure

The stimuli and procedure were similar to Study 1, but with several modifications to the paradigm. In Study 2, we expanded and modified our stimulus set to include 14 articles, 7 of which described more negative stories (e.g., hurricane damage, wildfires) and 7 of which described more positive stories (e.g., tree replanting, urban green spaces). In Study 1, the Control condition featured the original image for each article (as published); in Study 2, we instead fully randomized images across the message framing conditions.

We also added a donation task to assess prosocial behavior (Figure 1C). After viewing and providing ratings for all articles individually, participants viewed all articles again on the same page. Each article was associated with a cause; we provided participants with a $2 endowment. Participants used sliding scales ranging from 0-100% to allocate their funds to causes associated with each article. Alternatively, participants could choose to keep some or all of the endowment as a bonus payment. Donations were made on behalf of the participants at the end of the study. Bonus payments were awarded after study completion. We provided a general description of each cause instead of identifying specific charities (e.g., “Donations will help replant sequoia trees”, “Donations will support hurricane disaster relief”) to avoid confounding variables (e.g., familiarity, logos).

We also extended the study with a next-day memory test (Figure 1D). The next day, we invited participants to complete Session 2 of the study; we did not inform participants that there would be a memory test. For each article, as well as 10 novel lures, we assessed recognition memory for the general topic of the article (old/new). For old articles, we also assessed article text recognition (3-alternative forced choice among the Control, Action, and Crisis headline/lede variants), and image recognition (5-alternative forced choice among all possible images for each article; Original, Environment-Far, Environment-Near, Control-Far, Control-Near). For each article (presented in a randomized order), participants first responded to the topic recognition question, then responded to the text and image recognition questions on the next page of the survey (for old articles).

Statistical Analysis

As preregistered, we used one-tailed significance tests for analyses in which we aimed to replicate specific directional effects observed in Study 1. This policy was described in our preregistration and aligns with current best practices (Hales, 2023). For analyses relating affect ratings to reading and sharing intentions, we report *p*-values from two-tailed tests because we did not predict significant interactions. Analyses for measures that were added in Study 2 (donations, memory outcomes) used two-tailed tests.

Study 2 Results

Positive and Negative Affect Are Associated with Reading, Sharing, and Donating

We first tested the effects of positive and negative affect on reading intentions (Supplemental Figure 1A). To compare the effects of positive and negative affect, we predicted reading intentions from a combined affect variable (including both positive and negative affect ratings) and the interaction between affect and valence (positive vs. negative). There was a main

effect of affect predicting reading intentions (β = 0.14, 95% CI [0.12, 0.15], t = 19.21, p < 0.0001). Replicating Study 1, simple slopes indicated that both positive affect (β = 0.17, 95% CI [0.15, 0.19], z = 17.15, p < 0.0001) and negative affect (β = 0.11, 95% CI [0.09, 0.13], z = 10.76, p < 0.0001) were positively associated with reading intentions. There was also a significant interaction, indicating that the relationship between affect and reading intentions was stronger for positive affect than negative affect (β = 0.03, 95% CI [0.01, 0.04], t = 4.13, p < 0.0001).

In separate models, we repeated this analysis to test associations with broadcast and narrowcast sharing intentions (Supplemental Figure 2B, 2C). There were significant main effects of affect on broadcast (β = 0.08, 95% CI [0.07, 0.09], t = 14.41, p < 0.0001) and narrowcast intentions (β = 0.10, 95% CI [0.09, 0.12], t = 15.16, p < 0.0001). Simple slopes indicated that positive affect was positively associated with both broadcast (β = 0.10, 95% CI [0.09, 0.11], z = 14.01, p < 0.0001) and narrowcast intentions (β = 0.12, 95% CI [0.10, 0.13], z = 12.64, p < 0.0001). Likewise, negative affect was positively associated with both broadcast (β = 0.05, 95% CI [0.04, 0.07], z = 7.00, p < 0.0001) and narrowcast intentions (β = 0.09, 95% CI [0.07, 0.11], z = 9.35, p < 0.0001). Affect also interacted with valence for broadcast (β = -0.02, 95% CI [-0.03, -0.01], t = -4.71, p < 0.0001) and narrowcast intentions (β = -0.01, 95% CI [-0.002, -0.03], t = -2.00, p = 0.046); these interactions indicated that the relationship between affect and sharing intentions was stronger for positive affect than for negative affect.

Among the subset of participants who donated at least 1% of their endowment (N = 279, 70.6% of the sample), we tested whether positive and negative affect ratings (provided when first viewing an article) were related to subsequent donation amounts (Figure 4A). Using linear mixed-effects regression, we compared the relationship between affect and donations (percent of endowment donated, ranging from 0% to 100%) using a combined affect variable (including

both positive and negative affect ratings) and the interaction between affect and valence (positive vs. negative). There was a main effect of affect on donations (β = 0.06, 95% CI [0.04, 0.08], t = 5.20, $p < 0.0001$), with no significant interaction (β = 0.01, 95% CI [-0.01, 0.04], t = 1.12, p = 0.263). Simple slopes indicated that both negative affect (β = 0.07, 95% CI [0.04, 0.10], z = 4.30, $p < 0.0001$) and positive affect (β = 0.05, 95% CI [0.02, 0.08], z = 2.92, p = 0.004) ratings were positively associated with donations. We also conducted this analysis with the full sample of participants, including those who chose to keep the full endowment, and found similar results (Supplemental Material, *Study 2: Supplemental Results*). In sum, we replicated the effects of positive and negative affect on reading and sharing intentions observed in Study 1, and extended these findings to donations.

Message Framing Modulates Affect and Engagement

Next, we tested the effects of message framing on affect (Supplemental Figure 2E, 2F). Using separate linear mixed-effects regression models, we compared positive and negative affect across message framing conditions, conducting pairwise tests to contrast the three conditions (Crisis, Action, Control). Replicating Study 1, Action framing substantially increased positive affect (β = 0.34, 95% CI [0.29, 0.39], z = 14.40, $p < 0.0001$) and decreased negative affect (β = -0.14, 95% CI [-0.19, -0.09], z = -5.85, $p < 0.0001$) relative to the Control condition. In contrast, Crisis framing increased negative affect (β = 0.55, 95% CI [0.50, 0.59], z = 22.86, $p < 0.0001$) and decreased positive affect (β = -0.44, 95% CI [-0.48, -0.39], z = 18.56, $p < 0.0001$) relative to the Control condition. Accordingly, positive affect was greater in the Action condition relative to the Crisis condition (β = 0.77, 95% CI [0.73, 0.81], z = 34.83, $p < 0.0001$), and negative affect was greater in the Crisis condition (β = 0.69, 95% CI [0.64, 0.73], z = 30.44, $p < 0.0001$).

In separate models, we then tested the effects of message framing on reading, broadcast sharing, and narrowcast sharing intentions (Supplemental Figure 2). For each dependent measure, we analyzed the effect of message framing by conducting pairwise comparisons to contrast the three conditions (Action, Crisis, and Control). Replicating Study 1, we found that both Crisis framing and Action framing significantly increased reading intentions relative to the Control condition; there was no significant difference between Crisis and Action conditions (Crisis > Control: $\beta = 0.07$, 95% CI [0.03, 0.12], $z = 3.08$, $p = 0.001$; Action > Control: $\beta = 0.05$, 95% CI [0.002, 0.09], $z = 1.97$, $p = 0.024$; Crisis > Action: $\beta = 0.03$, 95% CI [-0.02, 0.07], $z = 1.18$, $p = 0.239$). As in Study 1, Crisis framing increased broadcast ($\beta = 0.03$, 95% CI [0.001, 0.07], $z = 2.03$, $p = 0.021$) and narrowcast ($\beta = 0.06$, 95% CI [0.02, 0.11], $z = 3.02$, $p = 0.001$) sharing intentions relative to the Control condition. However, Action framing did not significantly increase broadcast ($\beta = 0.02$, 95% CI [-0.01, 0.05], $z = 1.23$, $p = 0.109$) or narrowcast sharing intentions relative to the Control condition ($\beta = 0.02$, 95% CI [-0.03, 0.06], $z = 0.77$, $p = 0.219$). Relative to Action framing, Crisis framing significantly increased narrowcast sharing intentions ($\beta = 0.05$, 95% CI [0.01, 0.09], $z = 2.38$, $p = 0.009$), but not broadcast sharing intentions ($\beta = 0.01$, 95% CI [-0.02, 0.05], $z = 0.85$, $p = 0.199$).

We then applied the same approach to compare donations (percent of endowment donated, ranging from 0% to 100%) across message framing conditions (Figure 4B). Crisis framing increased donations relative to the Control condition ($\beta = 0.08$, 95% CI [0.002, 0.16], $z = 2.01$, $p = 0.044$) and the Action framing condition ($\beta = 0.08$, 95% CI [0.01, 0.16], $z = 2.25$, $p = 0.025$). Donations did not differ between the Action framing and Control conditions ($\beta = -0.004$, 95% CI [-0.08, 0.07], $z = -0.11$, $p = 0.912$). We also conducted this analysis with the full sample

of participants, including those who chose to keep the full endowment, and found similar results (Supplemental Material, *Study 2: Supplemental Results*).

Lastly, we tested whether affect mediated the effects of framing on reading intentions, sharing intentions, and donations. As in Study 1, for mediation analyses we grouped together the action and crisis framing conditions and compared this combined "treatment" condition with the control condition. As positive and negative affect had comparable effects on reading and sharing intentions, we calculated *total affect* as the sum of positive and negative affect ratings. Replicating Study 1, total affect mediated 89% of the effect of framing on reading intentions (indirect effect = 0.06, 95% CI [0.02, 0.10], $p = 0.002$). Similarly, total affect mediated 100% the total effect of framing on narrowcast sharing intentions (indirect effect = 0.03, 95% CI [0.001, 0.06], $p = 0.046$) and mediated 99% of the total effect on broadcast sharing intentions (indirect effect = 0.04, 95% CI [0.01, 0.08], $p = 0.034$). Among the subset of participants who donated at least 1% of their endowment, total affect also mediated 24% of the total effect of framing on donations (indirect effect = 0.01, 95% CI [0.01, 0.02], $p < 0.0001$). Detailed mediation results are reported in the Supplemental Table 7.

Effects of Message Framing and Affect on Memory

We investigated memory performance (Figure 1D) among the subset of participants who returned for the next-day memory test (N = 339). Memory accuracy for the gist of the articles (brief descriptions of the topics) was high and did not differ among conditions; detailed results for this measure are reported in the Supplemental Material (*Study 2: Supplemental Results*). Average recognition accuracy for the text of the old articles was 67.2%, significantly above chance (chance = 33.3%, $t(337) = 31.002$, $p < 0.0001$, Cohen's $d = 1.69$). Average recognition

accuracy for the images associated with the old articles was 64.4%, significantly above chance (chance = 20%, $t(337) = 35.6$, $p < 0.0001$, Cohen's $d = 1.94$).

The following analyses tested whether message framing and affect experienced during Session 1 predicted next-day memory accuracy. Using mixed-effects logistic regression, we predicted *recognition accuracy* (1 = hit, 0 = miss) for the text (headlines and ledes) of the old articles from *message framing* (Action, Crisis, or Control). The model also included a covariate of no interest to account for the delay (in hours) between Session 1 and Session 2 for each participant. Message framing significantly influenced text recognition (Wald $\chi^2(2) = 20.97$, $p < 0.0001$) (Figure 4C). Follow-up tests indicated that Action framing increased recognition accuracy relative to the Control ($\beta = 0.37$, 95% CI [0.20, 0.53], $z = 4.38$, $p < 0.0001$) and Crisis framing conditions ($\beta = 0.26$, 95% CI [0.11, 0.42], $z = 3.33$, $p = 0.001$). The Crisis framing condition did not differ from the Control condition ($\beta = 0.10$, 95% CI [-0.06, 0.26], $z = 1.23$, $p = 0.219$). We then predicted text recognition from affect (Figure 4E). There was no main effect of affect ($\beta = 0.004$, 95% CI [-0.05, 0.06], $z = 0.15$, $p = 0.879$), but affect interacted with valence ($\beta = -0.08$, 95% CI [-0.13, -0.03], $z = -3.00$, $p = 0.003$). Follow-up tests indicated that positive affect was associated with better text recognition ($\beta = 0.08$, 95% CI [0.01, 0.15], $z = 2.24$, $p = 0.025$), whereas negative affect tended to predict worse memory ($\beta = -0.07$, 95% CI [-0.15, 0.001], $z = -1.95$, $p = 0.052$) (Figure 4E). These findings indicate that Action framing and positive affect enhanced memory for article headlines and ledes.

We then applied the same approach to assess image recognition accuracy (Figure 4D). Image recognition accuracy differed among message framing conditions (Wald $\chi^2(2) = 19.21$, $p < 0.0001$). Follow-up tests indicated that Crisis framing decreased image recognition accuracy relative to the Control ($\beta = -0.35$, 95% CI [-0.52, -0.19], $z = -4.16$, $p < 0.0001$) and Action

framing conditions (β = -0.25, 95% CI [-0.40, -0.09], z = -3.13, p = 0.002). The Action framing condition did not differ from the Control condition (β = -0.10, 95% CI [-0.27, 0.06], z = -1.22, p = 0.222). Results from the affect model were similar to the results for text recognition (Figure 4F). There was no main effect of affect (β = -0.01, 95% CI [-0.06, 0.05], z = -0.27, p = 0.790), but affect interacted with valence (β = -0.12, 95% CI [-0.17, -0.07], z = -4.54, p < 0.0001). Follow-up tests indicated that positive affect was positively associated with image recognition (β = 0.11, 95% CI [0.04, 0.19], z = 3.01, p = 0.003), whereas negative affect was negatively associated with image recognition (β = -0.13, 95% CI [-0.20, -0.05], z = -3.32, p = 0.001). These findings indicate that Crisis framing and negative affect impaired memory for images.

In sum, results from Study 2 replicated and extended findings from Study 1, demonstrating that negative and positive emotions were both associated with increased reading intentions, sharing intentions, and donating. Importantly, Study 2 also revealed a key trade-off: Crisis framing had the strongest effects on immediate engagement (particularly donations and narrowcast sharing), but Action framing led to better memory for news content.

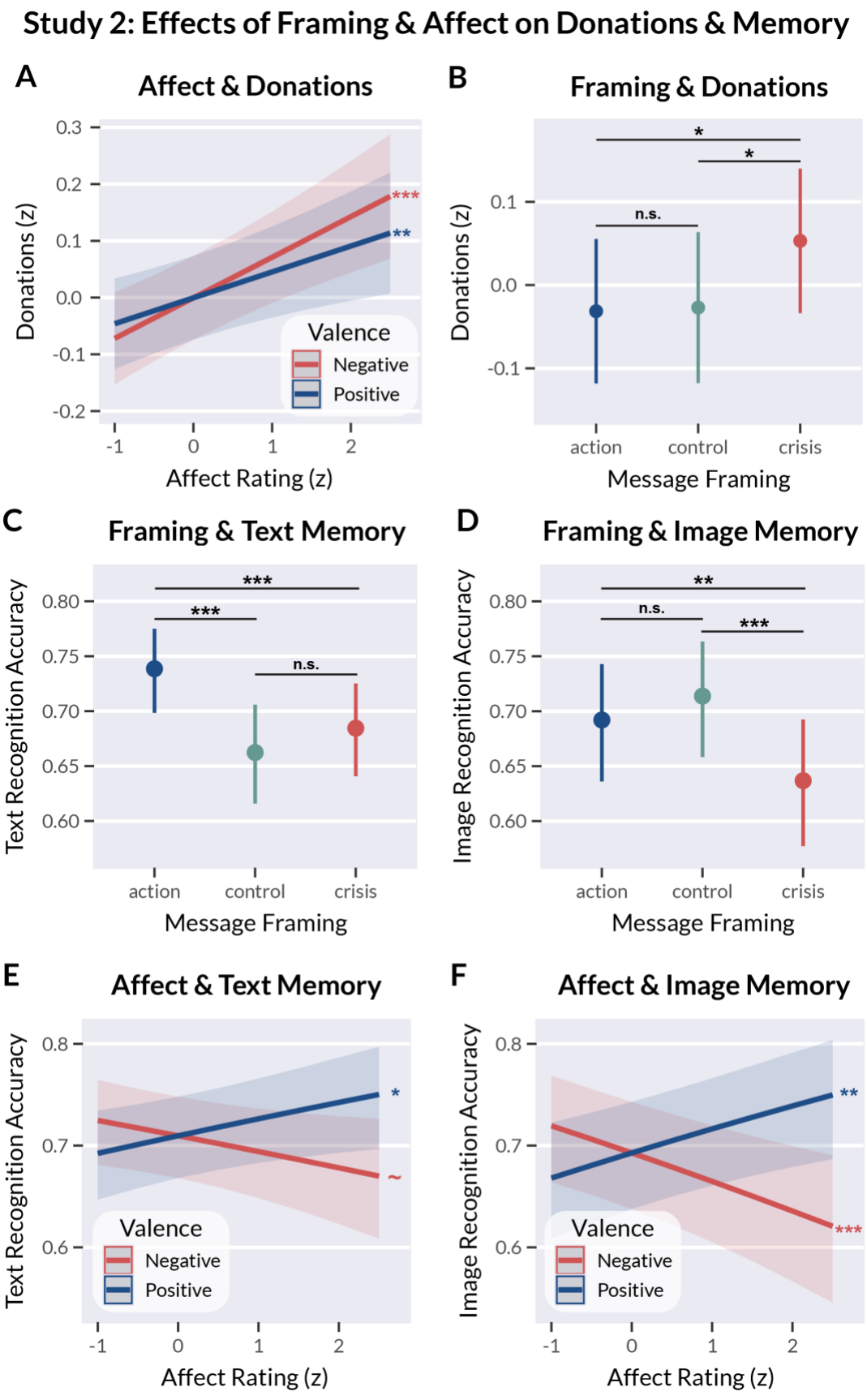
Study 2: Effects of Framing & Affect on Donations & Memory
A
Affect & Donations
Donations (z)
Affect Rating (z)
Valence
Negative
Positive
B
Framing & Donations
Donations (z)
n.s.
action
control
crisis
Message Framing
C
Framing & Text Memory
Text Recognition Accuracy
n.s.
Message Framing
D
Framing & Image Memory
Image Recognition Accuracy
n.s.
Message Framing
E
Affect & Text Memory
Text Recognition Accuracy
Affect Rating (z)
F
Affect & Image Memory
Image Recognition Accuracy
Affect Rating (z)

Figure 4. Study 2: Effects of Framing and Affect on Donations and Memory. A) Positive and negative affect were both positively associated with donations. B) Crisis framing increased donations relative to the Control and Action framing conditions. C) Action framing increased memory for article text relative to the Crisis and Control conditions. D) Crisis framing impaired memory for images associated with the articles, relative to the Action and Control conditions. E) Positive affect was associated with better recognition accuracy for article text, whereas negative affect tended to have the opposite effect. F) Positive affect elicited by the articles was associated with better recognition memory for images associated with the articles, whereas negative affect elicited by the articles was associated with worse memory performance. Plots depict estimates obtained from linear mixed-effects regression models, controlling for by-participant and by-article variance. Error bars and shaded bands indicate 95% confidence intervals. All significance tests were two-tailed. ~ $p<0.10$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$, n.s.=not significant.

Study 3

Findings from Studies 1 and 2 indicated that crafting headlines to emphasize either crisis or action can evoke emotions, thus increasing engagement. Having demonstrated experimentally that crisis and action framing can both increase engagement, we next investigated whether these effects generalized to real-world news engagement. In Study 3, we conducted a large-scale analysis of public engagement with >25,000 news headlines about climate change posted by major news outlets on Twitter/X.

Study 3 Methods

Data Source

Using Brandwatch (Brandwatch, n.d.), a third-party platform for social media data, we systematically searched for news articles about climate change posted on Twitter/X. We filtered our search to posts from 13 major news outlets on Twitter/X, identifying accounts with >1M followers (CNN, ABC News, The New York Times, Fox News, The Washington Post, BBC News, The Economist, The Wall Street Journal, Reuters, TIME, The Guardian, and The Huffington Post). We identified all posts from these news outlets that mentioned the key words

"climate change", "climate crisis", or "global warming". Posts all included links to articles; the text accompanying the links varied across posts, but generally included the article headline, lede sentence, and/or a featured quote from the article.

The analysis was limited to primary posts, excluding reposts and replies to other posts. In some cases, the same news outlet posted the same article multiple times (identical post text and article URL). For duplicate postings, we summed engagement metrics across entries and then removed duplicate rows. In other cases, the same headline was posted by multiple news outlets; as these posts reached different audiences, we did not treat these as duplicates. We obtained all posts from July 6th, 2010—July 22nd, 2024. Data prior to this period were not available from BrandWatch. The final sample included 25,272 posts.

Statistical Analysis

We used a large language model (LLM) to quantify the emotional content of the news headlines (Gemma Team et al., 2024). We used a few-shot prompt with five examples drawn from the stimuli used in Studies 1 and 2. We iteratively prompted the LLM with the instruction text and the content of one post (post text, excluding the article URL); each post was evaluated independently. The LLM was not provided the engagement metrics associated with each post. The LLM assigned a framing score to each headline (0=strong crisis/negative framing, 5=neutral framing, 10=strong action/positive framing). We validated that the LLM ratings were comparable to human ratings (ICC=0.83, good agreement). Additional information about the prompt and model validation can be found in the Supplemental Material.

In separate linear mixed-effects regression models, we predicted *reposts* and *likes* for each post. We investigated how these engagement metrics related to *message framing*, continuous scores obtained from the LLM (0=strong negative/crisis framing, 5=neutral,

10=strong positive/action framing). We predicted non-linear, U-shaped functions, which would indicate that both crisis and action framing increase engagement relative to neutral framing. To test this prediction, we included quadratic terms in each model (message framing, squared). Each model included random intercepts for news outlets and random slopes for message framing.

Study 3 Results

Reposts

First, we investigated the relationship between message framing and reposts. There was a robust quadratic relationship between message framing and reposts, indicating a non-linear association ($\beta = 0.07$, 95% CI [0.05, 0.08], $t = 10.20$, $p < 0.0001$). There was also a significant linear association ($\beta = -0.05$, 95% CI [-0.07, -0.03], $t = -4.44$, $p = 0.0006$), indicating that headlines with strong crisis framing yielded more reposts than headlines with strong action framing, though the effect size was small. Overall, there was a strong, nearly symmetric U-shaped relationship between message framing and reposts (Figure 5A).

Interestingly, visualization of random slopes suggested that the effects of action framing on reposts were less variable (across news outlets) than the effects of crisis framing. To quantify this observation, we extracted predicted values for retweets from our model, for each news outlet and each level of message framing (0-10). For each level of message framing, we defined *variability* as the standard deviation of predicted retweets (box-cox transformed for non-normality). We then used linear regression to test whether variability differed depending on message framing. There was a strong negative association between message framing and variability ($\beta = -0.99$, 95% CI [-1.10, -0.88], $t = -20.21$, $p < 0.0001$). These findings suggest that action framing may consistently increase engagement, whereas the effects of crisis framing may depend more on contextual variables (e.g., the audience).

Likes

Next, we used linear mixed-effects regression to investigate the relationship between message framing and *likes* (Figure 5B). As with reposts, there was a robust quadratic relationship with message framing (β = 0.05, 95% CI [0.03, 0.06], $t = 6.89$, $p < 0.0001$). The linear term was not significant (β = -0.01, 95% CI [-0.04, 0.03], $t = -0.43$, $p = 0.669$), indicating that crisis and action framing had similar effects (i.e., a symmetric U-shaped function).

Visualization of random slopes indicated that two outlets showed notably asymmetric slopes. Crisis-framed headlines from Fox News generated far more likes than action-framed headlines. In contrast, The New York Times showed the opposite effect, indicating a bias in favor of action framing. Using linear regression (including news outlet as a fixed effect instead of a random effect) we tested for an interaction between message framing and news outlet predicting likes. News outlet interacted with both the linear ($F(12, 25233) = 4.13$, $p < 0.0001$) and quadratic terms ($F(12, 25233) = 13.31$, $p < 0.0001$) for message framing. Follow-up tests confirmed that only Fox News showed a strong negative linear association (β = -0.26, 95% CI [-0.35, -0.16], $t = -5.18$, $p < 0.0001$), whereas only The New York Times showed a positive linear association (β = 0.09, 95% CI [0.05, 0.13], $t = 4.48$, $p < 0.0001$). Detailed results comparing slopes across news outlets are reported in Supplemental Table 8.

Replies

Lastly, we conducted the same analysis to examine *replies*, comments on the news headlines (Figure 5C). We again observed a quadratic relationship between message framing and replies (β = 0.01, 95% CI [0.001, 0.03], $t = 2.17$, $p = 0.030$). The linear term was not significant (β = -0.05, 95% CI [-0.10, 0.01], $t = -1.82$, $p = 0.100$). Both action and crisis framing were

associated with more replies, though the effect size was weaker than the effects observed for reposts and likes.

Visualization of random slopes indicated that Fox News was a notable outlier—headlines with strong crisis framing elicited far more replies than other headlines. Using linear regression (including news outlet as a fixed effect instead of a random effect), we tested for an interaction between message framing and news outlet predicting replies. News outlet interacted with both the linear ($F(12, 25233) = 5.26$, $p < 0.0001$) and quadratic terms ($F(12, 25233) = 1.89$, $p = 0.031$) for message framing, confirming that the effects of message framing differed among outlets. Fox News showed a strong negative linear association between message framing and replies, indicating a negativity bias for replies ($\beta = -0.38$, 95% CI [-0.47, -0.28], $t = -7.72$, $p < 0.0001$). Detailed results comparing slopes across news outlets are reported in Supplemental Table 9.

Overall, we found that message framing was strongly related to real-world engagement with climate news—reposting, liking, and replying to headlines posted by news outlets on social media. Users were most likely to like and share news articles with strong crisis framing *or* strong action framing. There was a similar effect of framing on replies, although this effect was considerably weaker than the effects on reposts and likes. This analysis also revealed interesting differences among news outlets, underscoring that different emotional appeals may resonate with different audiences.

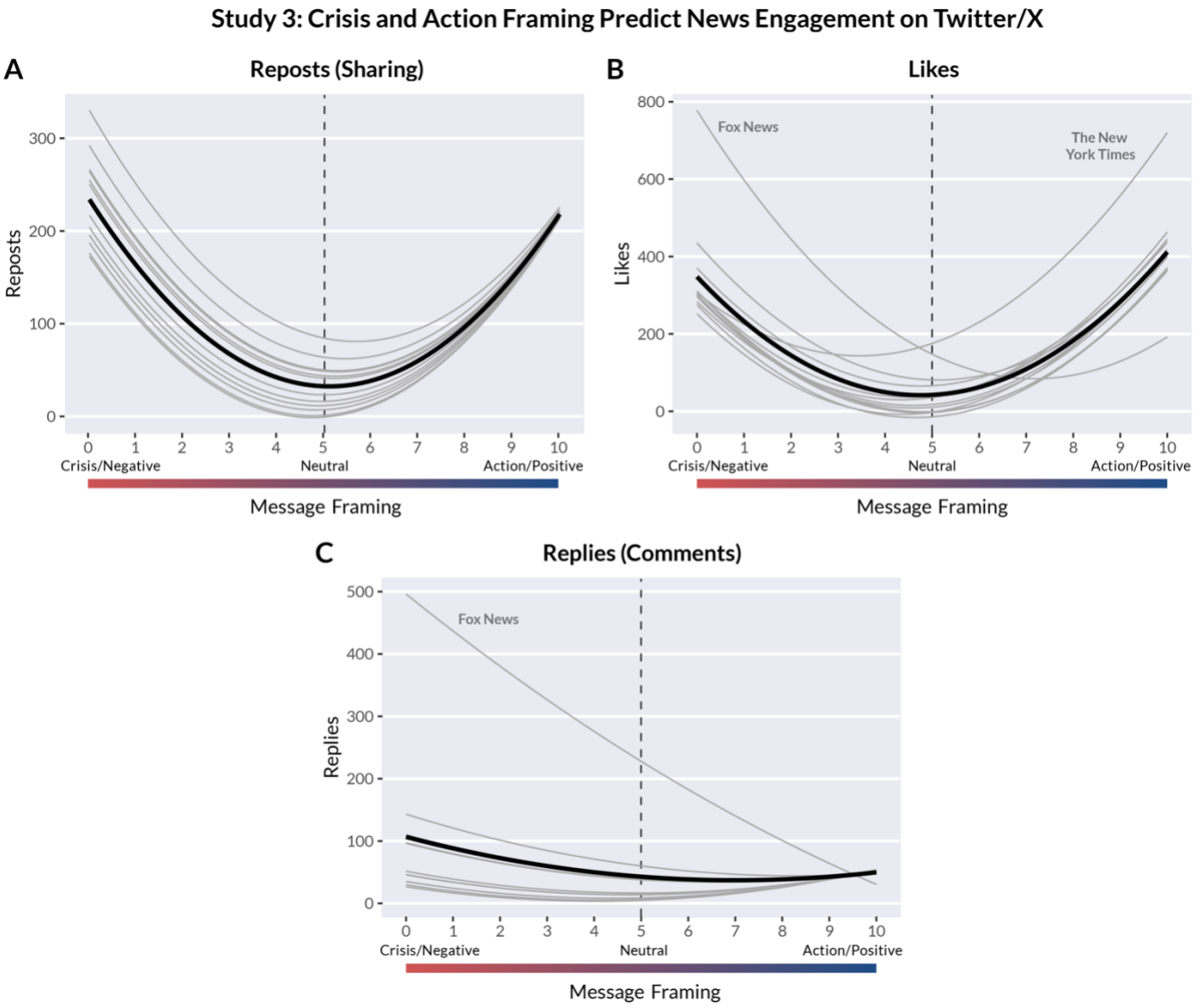

Figure 5. Reposts (A), likes (B), and replies (C) for climate news headlines on Twitter/X. Bold black lines indicate group level slopes estimated from a linear mixed-effects regression model (including linear and quadratic terms for message framing). Thin gray lines indicate slopes for each news outlet. Outlets with trends that deviate substantially from the group estimates are labelled in gray text. The x-axis depicts message framing ratings obtained from an LLM, ranging from 0 (strong crisis/negative focus) to 10 (strong action/positive framing). Dotted lines mark the midpoint of the scale.

General Discussion

We investigated how affective framing of news influences engagement. In two experiments (one preregistered), we adapted news headlines about climate change to emphasize different aspects of each story, emphasizing Crisis (disaster and urgency) or Action (progress toward future goals). Crisis and Action framing strongly evoked negative and positive emotions, respectively. Importantly, both positive and negative emotions were associated with increased intentions to read and share news articles, and donate to related causes. Crisis framing had the strongest effects on immediate engagement, but Action framing enhanced memory for news content. In a third study, we analyzed real-world news engagement on social media, finding that both Crisis and Action framing were associated with increased reposts, likes, and replies.

Affective Framing Influences Reading, Sharing, Donations, and Memory

In Study 1, we found that positive and negative affect evoked by news headlines were both associated with increased reading and sharing intentions. In Study 2, we replicated these effects and showed that positive and negative affect were also associated with real donations to charities related to the articles. Importantly, positive affect had equally strong (Study 1) or stronger (Study 2) effects on engagement, relative to negative affect. These findings contrast with prior evidence that negativity drives news consumption, relative to neutral and positive information (Robertson et al., 2023; Rozin & Royzman, 2001), and challenge the idea that journalists must emphasize negative stories to increase engagement (Baumeister et al., 2001; Pooley, 1989; Stieglitz & Dang-Xuan, 2013). These results align with other evidence that strong emotions, particularly those that elicit "approach" motivation (e.g., anger, hope), can motivate information seeking and sharing (Berger & Milkman, 2012; de los Santos & Nabi, 2019) as well as donating (Cunningham et al., 1980; Fiala & Noussair, 2017). Our results are also consistent

with *Emotional Broadcaster Theory,* which argues that strong positive and negative emotions both motivate people to share stories (Harber & Cohen, 2005).

Message framing also influenced affect and engagement. In Studies 1 and 2, Crisis framing strongly increased negative affect and decreased positive affect, whereas Action framing had the opposite effects. Relative to the unaltered headlines, Action and Crisis framing both increased intentions to read the articles (Studies 1 and 2) and share the articles broadly on social media (Study 1). Overall, Crisis framing elicited the greatest engagement. Crisis framing (but not Action framing) also increased intentions to share the articles directly with a known other (Studies 1 and 2) and donations to causes associated with the articles (Study 2).

Importantly, Crisis and Action framing offered distinct benefits. Crisis framing had the strongest effects on immediate engagement (reading, sharing, and donating), but impaired future memory for news content. In contrast, Action framing enhanced memory. This trade-off aligns with the Imperative/Interrogative Theory of Motivation, which describes how urgent vs. future-oriented goals shift the balance between neural systems that support urgent goal-directed behavior vs. detailed memory formation (Chiew & Adcock, 2019; Dickerson & Adcock, 2018; Murty & Adcock, 2017; Sinclair et al., 2023). Communicators could thus tailor messages to maximize immediate engagement or increase hope and memorability.

Taken together, these findings suggest that positive and negative emotions can have equally strong effects on engagement, although it may be easier to elicit strong negative emotions (explaining the overall benefit of Crisis framing). These findings help to clarify and reconcile past findings—some evidence suggests that negativity alone drives news consumption (Robertson et al., 2023) and information sharing (Bellovary et al., 2021; Schöne et al., 2021), whereas other evidence suggests that strong positive and negative emotions both increase

engagement (Berger & Milkman, 2012; Harber & Cohen, 2005). Importantly, Crisis and Action framing both increased engagement relative to the unaltered headlines, indicating that Action framing is an effective strategy for increasing engagement without fear-mongering. These findings are particularly important given that negative news can harm mental health (de Hoog & Verboon, 2020; Knobloch-Westerwick, 2021; Stainback et al., 2020) and could discourage sustained action to address societal challenges like climate change (Chapman et al., 2017; Vlasceanu et al., 2024).

In Study 3, we tested whether our findings generalized to a real-world social media context. We used AI to classify Action and Crisis message framing in headlines about climate change posted by news outlets on Twitter/X. Replicating our experimental findings, headlines with strong Action or Crisis framing were more likely to be liked and reposted (approximately 4x more engagement than neutral framing). Interestingly, Crisis framing was associated with greater variability in reposts across news outlets, whereas Action framing had a more consistent effect. Results for likes revealed that *Fox News* showed a negativity bias in engagement, whereas *The New York Times* showed a positivity bias. These results demonstrate how the effects of message framing can vary across audiences.

Limitations and Future Directions

We found that positive and negative emotions both predicted reading intentions, sharing intentions, and donations. However, Action framing did not strongly increase sharing and donating relative to the unaltered headlines, suggesting that our Action headlines may not have consistently evoked strong positive emotions. On the basis of prior studies, we focused on high-arousal emotions like fear and hope (Berger et al., 2021; Berger & Milkman, 2012; Feldman & Hart, 2018). Future research could adapt our paradigm by collecting continuous measures of

arousal and investigating potential moderation effects (e.g., high-arousal negative emotions like anger may have stronger effects than low-arousal negative emotions like sadness) (Clewett & Murty, 2019; Kensinger, 2004). In addition, we demonstrated that Action and Crisis framing were both associated with social media engagement, but media environments are also shaped by algorithms selectively amplify content based on predicted virality or users' interests. Future research could explore whether our results generalize to news topics beyond climate change, and whether affective framing also influences memory for information encountered during naturalistic media consumption.

Conclusion

Humans are biased to attend to negative information, and the idea that negativity drives engagement is pervasive in journalism. However, negative news can harm mental health and discourage action to address societal challenges like climate change. We show that strong negative and positive emotions can both drive engagement with news content, motivating reading, sharing, and donating in laboratory and real-world settings. Emphasizing crisis can maximize immediate engagement, but emphasizing action can still increase engagement (relative to neutral framing) while inspiring hope and enhancing memory for news content. Our results unify discrepant prior findings and test key theoretical predictions, offering broad implications for research on affect, information consumption, memory, prosocial behavior, climate communication, and media psychology.

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