Hope, Fear, or Anger? How Emotional Framing in a News Recommender System Guides User Preferences

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Abstract

News recommender systems (NRSs) increasingly leverage artificial intelligence to automate journalistic processes and tailor content to individual users. These systems shape the patterns of news consumption. The emotional reframing of the content of the news article, applied through large language models (LLM), has the potential to influence the selection of the articles of users and guide them towards specific content. This paper explores how emotional reframing of news articles can influence user engagement, interaction, and openness to non-preferred content. We present the results of a user study ($N = 150$) on a news platform. The way news articles were presented was subject to a 3x2-mixed research design. News articles were rewritten using a large language model (LLM) in one of three emotional tones: fearful, angry, or hopeful. Moreover, articles either aligned with the user's emotional state and topical preferences or not. These emotionally reframed articles either aligned or misaligned with users' self-reported emotional state to examine the effect of emotional alignment. The results show that emotional alignment significantly increased the likelihood that users selected an article as their favorite, even when it belonged to their least preferred topic category. This finding suggests that emotional alignment can guide users toward content they might otherwise avoid, offering a potential means to reduce selective exposure. In terms of behavioral engagement, articles reframed with an angry tone significantly led to longer reading times, while fearfully framed articles were more likely to be clicked. In contrast, hopeful framing resulted in reduced interaction, which suggests that negative rather than positive emotions increase user engagement.

Keywords

News Recommender System, Affective Framing, Emotions, Large Language Models, User Engagement, Selective Exposure, Polarization,

1. Introduction

1.1. Motivation and Problem Statement

The news industry serves a diverse audience with varying interests and preferences. The shift to digital platforms has transformed how news is consumed, enabling real-time updates and increasing competition for user attention. For publishers, attracting more readers directly correlates with higher revenues, since more users are likely to pay for premium content. In this context, news recommender systems (NRS) have become crucial in shaping users' engagement and perceptions of news content [1, 2, 3, 4, 5]. Recent advances in large language models (LLMs), such as GPT, are reshaping newsroom workflows by automating tasks. As AI becomes more integrated into news delivery, LLMs open new possibilities to personalize not just content topics, but also emotional tone to match the current states of users [6, 7].

Although NRSs are effective in providing personalized content tailored to individual preferences [8], they can also lead to unintended consequences. One major concern is selective exposure, which refers to the tendency for users to seek information that aligns with their pre-existing beliefs and to avoid content that challenges their views [9, 10, 8]. This phenomenon narrows the informational exposure of users, as NRS reinforces existing preferences by repeatedly recommending similar content. As a

result, users may become less likely to engage with articles that offer contrasting perspectives, limiting viewpoint diversity, and affecting their overall engagement with news content [11, 12].

These challenges motivate the exploration of alternative approaches to personalization—ones that do not simply reinforce user preferences but instead encourage broader engagement. Rather than focusing solely on topical relevance, this research investigates whether emotional framing, specifically the alignment between an article's emotional tone and a user's current emotional state, can influence user behavior.

Previous studies have examined how emotional tones impact user responses [13, 14], particularly in how article framing affects readers' emotional states. However, this work takes a different direction: It tests whether matching (or mismatching) the emotional tone of an article with the user's current state influences engagement. The hypothesis is that emotional alignment may increase openness to non-preferred content.

Despite its potential, emotional reframing is an underexplored strategy in NRS, in part due to the inherent difficulty in accurately detecting and adapting to user emotions in real time [15]. This study therefore not only investigates the impact of emotional alignment, but also reflects on the practical and technical challenges that may have limited its adoption. Although selective exposure is not measured directly, this study aims to assess whether emotionally adaptive content can reduce user avoidance of least preferred topics.

1.2. Research Gap and Objective

The digital news ecosystem increasingly depends on personalized recommender systems to drive readership and revenue. However, this same personalisation can exacerbate selective exposure, narrowing user information diets and weakening journalism's public-sphere function. Even a modest increase in engagement at major outlets, such as The Washington Post, can translate into tens of thousands more reads [16], highlighting both the value and the risk of optimizing what people click on. Users persistently opt for content that corresponds to their pre-existing beliefs, leaving open the question of how to foster openness without violating personal relevance [10].

Previous research has shown that exposing the reader to diverse viewpoints can improve their understanding of complex issues and help counteract political and ideological polarization [17]. At the same time, recent advances in large language models (LLMs) enable dynamic reframing of news content into distinct emotional tones. However, a critical question remains underexplored: Can *aligning the emotional tone of an article with the current emotional state of the reader* increase openness to content they would otherwise avoid, thus mitigating selective exposure?

This study addresses this gap by experimentally testing how emotional alignment (match vs. mismatch) and specific emotional frames (fear, hope, anger) influence user engagement and behaviors.

The participants first read a set of neutral articles and then encountered emotionally reframed versions, with the tone systematically manipulated using LLM. Their behavioral data (e.g., click patterns, dwell time) are analyzed to answer two key research questions:

- *RQ1: To what extent does emotional alignment between a user and a news article affect the selection of news article, and openness to non-preferred news category?*
- *RQ2: How do different emotional framings (fear, hope, anger) influence user engagement metrics such as reading time and clicks?*

By integrating emotional framing theory with user behavior analysis, this work contributes empirical evidence on whether emotionally adaptive NRSs can promote broader, healthier news consumption, without sacrificing the benefits of personalization.

1.3. Contribution of Current Research

This research investigates how emotional alignment—matching a user's current emotional state with the emotional tone of a news article—affects interaction, engagement and openness to non-preferred

topics. Although prior studies have explored emotional framing in isolation or its effect on emotional responses [13, 14], few have tested its behavioral implications within a personalized news recommender system (NRS) context using articles reframed with LLM. Furthermore, emotional alignment remains an underexplored mechanism for mitigating selective exposure and directing users toward diverse news content.

Our contributions to the field are as follows:

1. **Empirical Test of Emotional Alignment in NRSs:** This research presents one of the first empirical investigations of emotional alignment as a personalization strategy. Using a LLM-reframed news content (hope, fear, anger), the research demonstrates that aligning the emotional tone with the user's current emotional state significantly increases the likelihood of article selection, even when the article belongs to the least preferred topic category.

2. **Behavioral Insights into Emotional Framing:** We provide evidence that emotionally framed content influences different behavioral outcomes. Fearful frames increase clicks, anger extends reading time, and hope has a neutral or dampening effect. These findings suggest that negative emotional tones are more effective in nudging engagement within a recommender system, offering actionable insights for designing emotionally adaptive news platforms.

3. **Design of an Emotion-Aware Recommender:** We present a knowledge-based news recommender system that personalizes the news by aligning the emotional tone with the user's emotional state. This approach shows promise in reducing selective exposure by increasing engagement with articles in least preferred topic categories.

2. Related work

Recommender systems shape digital news consumption, but personalization can reinforce selective exposure—users favor content aligning with their beliefs and avoid opposing views—limiting diversity and increasing polarization [9, 11, 10]. Advances in large language models, such as ChatGPT enable emotional reframing of news content, which may have potential to address the adverse effects of selective exposure. Previous work shows that anger and fear framing triggered stronger negative emotional responses compared to a neutral baseline, whereas hope had minimal emotional impact [13]. Yet, emotional alignment—matching article tone with user emotion—remains underexplored.

This study connects recommender systems and emotion by testing whether emotional alignment increases engagement. We focus on fear, anger, and hope—emotions shown to drive behavior and motivation [18, 19, 20, 21, 22, 23, 24]. While emotion-aware RSs are rare due to detection and ethical concerns [15], this work shows that self-reported emotions has the potential to support ethical personalization and reduce selective exposure.

2.1. News Recommender Systems

Recommender systems have evolved significantly since their early applications in the 1990s, which began with systems, such as Tapestry and GroupLens, initially developed for filtering personal emails and news content [25, 26]. These early systems introduced collaborative filtering, a method that predicts user preferences by analyzing past interactions. Over the following decades, recommender systems advanced through matrix factorization. Beyond technical development, research has increasingly emphasized user experience, social impact, and privacy [25]. As [27] notes, recommender systems serve as tools to navigate complex information spaces by prioritizing content that aligns with user interests. With the overwhelming volume of online content, effective recommendations are essential to enhance user satisfaction.

News recommender systems (NRS) address the unique demands of digital news, where thousands of articles are published daily but quickly lose relevance. Unlike movies or books, news content has a short shelf life and brief engagement time, making timely, personalized delivery essential. However, such personalization may reinforce users' existing preferences, leading to filter bubbles or echo chambers.

To mitigate these effects, [28] highlight the importance of diversity and novelty in recommendations. In particular, overly personalized news content may contribute to selective exposure and societal polarization [10].

In line with this, [15] proposed the Emotion-Aware Recommender System (EARS), which personalizes news based on users' self-reported emotions rather than past behavior. Although we do not implement their system, we adopt a similar method by collecting users' emotional states at the beginning of the session.

Recommender systems traditionally use collaborative filtering, which leverages patterns from similar users, or content-based filtering, which matches items to a user's previous preferences [29, 30]. These systems often use metadata and preference matrices to improve recommendation accuracy [30]. This study takes a different approach by using a knowledge-based recommender system (KBRS), which asks users to explicitly state their preferences. KBRS is particularly useful in cold start situations, where a limited user history makes traditional methods less effective [31]. Instead of learning from previous behavior, KBRS relies on predefined rules or cases. Constraint-based recommenders match users with content using rule-based logic [32], while case-based systems compare user profiles to previous similar users [33].

In this study, the constraint-based approach is used. KBRS is well-suited for addressing cold-start problems, where limited user data hinders recommendation accuracy. By asking users to select their favorite and least favorite topics, it allows immediate and relevant personalization [31]. Furthermore, this study takes ethical considerations into account. The news platform is designed to provide recommendations without needing to collect sensitive user data, prioritizing user privacy and comfort while maintaining effective recommendations.

In summary, recommender systems have evolved from early filtering tools to complex, user-centered technologies. News recommender systems face unique challenges due to short content lifespans and risks, such as selective exposure. This study uses a knowledge-based approach that integrates user-stated preferences and emotions to support diverse personalized news recommendations.

2.2. Emotions

The three emotions that we will investigate are fear, anger, and hope. All three emotions are capable of driving people to act differently. Using that knowledge, our objective is to investigate how aligning or contrasting the emotional tone of news articles with a user's current emotional state affects the selection of news articles and engagement. Our findings offer insights into how emotional responses relate to content preferences, including those typically associated with selective exposure.

2.2.1. Fear Emotion

Fear is an emotion that motivates action by emphasizing negative consequences. A typical example is the graphic warning label on cigarette packs in many European countries, which aims to discourage smoking through fear appeal, defined as "a direct statement that highlights the negative effects of something" [19]. While effective in some cases, repeated exposure can lead to desensitization, weakening the intended response.

According to [19], fear appeals are most effective when two conditions are met: (1) individuals believe they can change their behavior (self-efficacy), and (2) the level of fear is strong enough to prompt a response without overwhelming. Otherwise, fear can lead to denial or avoidance instead of action.

Fear is one of the three emotions explored in this study, alongside anger and hope. It plays a complex role in communication, influencing attention and risk perception, but also causing disengagement. The Extended Parallel Process Model (EPPM) explains this duality by distinguishing between adaptive (behavioral change) and maladaptive (defensive avoidance) responses [18].

Although not directly applied in our design, EPPM offers valuable insight for interpreting user behavior. For instance, engagement with fear-based articles may suggest adaptive responses, whereas consistent avoidance may indicate overload. According to the model, effective fear appeals combine

high perceived threat with high perceived efficacy to encourage danger control rather than fear control [18].

2.2.2. Anger Emotion

Anger can exert a strong influence on human behavior [19]. Similarly to fear, it is a negative emotion, but more intense and often a strong motivator to influence people's behavior [34]. Research has shown that anger motivates political participation. For example, U.S. political campaigns have used anger to create urgency and opposition, encouraging voter turnout by highlighting threats from the opposing party [19].

Weber's studies further distinguish anger from fear: while fear can lead to passivity, anger increases conviction and engagement, particularly in political contexts [19]. Similarly, [13] found that anger-framed articles elicited stronger negative emotional reactions.

Lench's work also supports this idea. In studies of the 2016 and 2020 U.S. elections, those people who answered with anger to their candidate losing were more likely to be voters in the next election [20]. However, anger is not always productive. For example, [19] note that charity collectors expressing anger about small donations received fewer contributions, showing that misdirected anger can backfire and discourage cooperation.

Taken together, these findings suggest that anger has the potential to increase engagement in news recommender systems, especially by capturing attention and driving interaction. In this study, we investigate whether anger-framed articles promote user engagement through increased reading time and click behavior.

2.2.3. Hope Emotion

Hope, in contrast to fear and anger, is a positive emotion that inspires individuals to strive for a better future. According to Snyder's Hope Theory, hope consists of two elements: agency - the perceived capacity of one to achieve goals - and pathways - the strategies used to achieve them [24]. These components foster an action-oriented mindset that helps people overcome challenges. Hope motivates people by emphasizing solutions and the possibility of success, particularly in difficult situations [24].

Hope can be classified as either passive or active [23]. Passive hope involves relying on external actors, such as corporations, to effect change; for example, passive hope might be invoked by reframing an article about climate change to encourage readers to place hope in larger corporations to take meaningful action. Since such companies are responsible for a large part of the pollution, their efforts to reduce it could have a far greater impact than those of any individual [35].

A 2019 study by [22] showed that increasing the "pathways" aspect of hope significantly improved educators' engagement in climate discussions. This aligns with our study's focus on how hope, particularly through actionable reframing, can increase user interaction with emotionally or politically complex news. Prior work by [13, 14] also suggests that hope-framed content generally elicits more neutral emotional responses than anger, indicating that hope's effects may be subtler but still impactful.

In this study, hopeful reframing aims to encourage readers to interact with news content they might otherwise overlook, by highlighting achievable solutions and opportunities for positive action.

2.3. Emotional News Framing

News framing plays a central role in shaping public perception by emphasizing certain aspects of reality over others. Framing is to select and highlight specific elements of a perceived issue in order to promote a particular problem definition, causal interpretation, or moral evaluation [36]. Through this selection process, framing increases the salience of information, guiding how audiences interpret, remember, and respond to news content [37, 38].

Framing is particularly influential in political and social contexts, where complicated issues need to be explained in a clear and relatable way. Journalists rely on frames to convey meaning, suggest responsibility, and shape public discourse [39].

Furthermore, emotional framing also referred to as affective framing, which focuses on the emotional tone embedded in news content. Rather than simply conveying facts, it invokes specific feelings, such as fear, hope, or anger, to shape the reader's emotional response. This form of framing is often intuitive, structuring information in a way that resonates on a first-person affective level [40, 41].

Research has shown that emotional frames can meaningfully influence attitudes and decision-making. For example, positive emotional framing has been associated with greater support for environmental policies [42], while exposure to negatively framed content has been found to intensify readers' emotional responses and increase behavior intentions such as environmental protection [43].

In this study, we apply emotional framing through the use of large language models (LLMs) to reframe news articles into hopeful, fearful, or angry tones. This allows us to explore how alignment or misalignment between a user's current emotion and the emotional tone of content influences their selection of articles and engagement.

2.4. Selective Exposure

News recommender systems aim to tailor content to individual preferences, but this personalization can unintentionally reinforce existing beliefs of users. This tendency, known as selective exposure, refers to the preference of people for information that supports their views while avoiding content that challenges them [44, 45, 46]. By filtering content in this way, people avoid the discomfort of cognitive dissonance and instead seek affirmation through ideologically aligned information.

In digital journalism, selective exposure is amplified by both user behavior and algorithmic filtering. Users naturally gravitate toward news that aligns with their attitudes, while recommender systems, designed to optimize engagement, often reinforce these preferences by repeatedly suggesting similar content [46]. As a result, users may be exposed to a narrower range of viewpoints, limiting different perspectives and increasing the risk of polarization [47, 8]. Studies have shown that people spend more time reading articles that reflect their views [46, 9, 48, 11, 12]. Two distinct user patterns often emerge: some explore diverse news sources but still prefer familiar viewpoints, while others rely exclusively on ideologically congruent outlets [49]. These negative effects arise from two factors: (1) user-driven selectivity, rooted in individual attitudes and behaviors, and (2) algorithmic bias, often referred to as the filter bubble effect. While both factors contribute to the narrowing of informational diversity, this study focuses primarily on the role of user attitudes in shaping selective exposure. It further explores interventions that may help reduce its adverse impact.

This paper addresses the user-driven aspect of selective exposure by shifting the focus from topic-based personalization to emotional framing. Instead of recommending articles solely based on topical relevance, we examine whether aligning the emotional tone of news articles with users' self-reported emotional states can influence their article selection and engagement. Specifically, we test whether emotional alignment can increase the likelihood of users choosing content from categories they typically avoid. In doing so, we investigate emotional personalization as a potential strategy to mitigate selective exposure and promote openness to more diverse news content.

3. Methods

3.1. Research design

This study employed a two-group between-subjects experimental design to examine whether emotional reframing of news articles using large language models (LLMs) can influence users' selection of articles and engagement, towards content that users would not typically prefer, and also how the different frames affect their interactions. The key manipulation involved emotional alignment, whether the emotional tone of an article matched the participant's self-reported emotional state, and whether this alignment occurred within their most preferred or least preferred category.

Participants were randomly assigned to one of two experimental conditions:

- Condition 1 (Aligned favorite): Emotional alignment occurred in the participant's most preferred news category. Articles from their least preferred category were reframed using one of the two remaining emotional tones (not matching the participant's emotional state), with consistent tone framing across the topic.
- Condition 2 (Aligned least favorite): Emotional alignment occurred in the participant's least preferred news category. Articles from their most preferred category were reframed in one of the two remaining emotional tones (not matching the participant's emotional state).

3.2. System & Dataset

We developed a news platform using the Django framework that could present emotionally reframed news articles. The frontend was built using HTML, CSS, and JavaScript, and the backend was implemented in Python.

Our content was drawn from the Washington Post dataset, which includes a large selection of opinion articles. From this dataset, we sampled 50 articles from each of three emotion-sensitive categories: **Politics**, **Immigration**, and **Climate & Environment**, resulting in 150 base articles. These categories were selected based on prior literature identifying their capacity to evoke emotional responses such as fear, hope, and anger [21, 50, 51]. All articles were English-language opinion pieces, preprocessed for consistent formatting.

3.2.1. Model Selection

To generate emotionally reframed content, we used OpenAI's GPT-4o model [52]. For each article, the API produced three reframed versions, targeting hopeful, fearful, or angry emotional tones. While GPT-4o supports multimodal input, we excluded images from all versions to minimise visual bias and isolate textual framing effects.

Statistical analyzes and model building were performed in Python to assess the effects of the experimental conditions. Logistic regression was employed to model the likelihood of favourite selection and article clicks based on alignment and category variables. One-way ANOVA (with Tukey HSD post hoc) tested framing effects on time spent per article.

3.3. Procedure

As illustrated in Figure 1, the procedure involved seven stages. Participants ($N = 150$, recruited via Prolific) first completed a short intake form reporting demographics and their current emotional state (hope, fear, or anger). They then browsed an initial news page containing 21 unmodified articles (7 per category), serving as a baseline.

Next, participants indicated their most and least preferred topics. Based on these responses and their emotional state, they were randomly assigned to one of two experimental conditions:

- **Emotionally Aligned – Preferred**: Emotionally aligned content was presented in the user's preferred category.
- **Emotionally Aligned – Least Preferred**: Emotionally aligned content was presented in the user's least preferred category.

On the second news page, participants viewed emotionally reframed articles from only their preferred and least preferred categories (see Figure 2 for an example of the least preferred category). Please refer to footnote 1 to inspect the prompts used in our study[1]. A 60-second timer was shown on the first page and a 90-second timer on the second, to reduce skimming while still allowing free interaction. The participants selected one article as their favorite.

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[1]The prompts we used in ChatGPT-4o to reframe news articles are here: https://anonymous.4open.science/r/RecSys2025-28F0/README.md
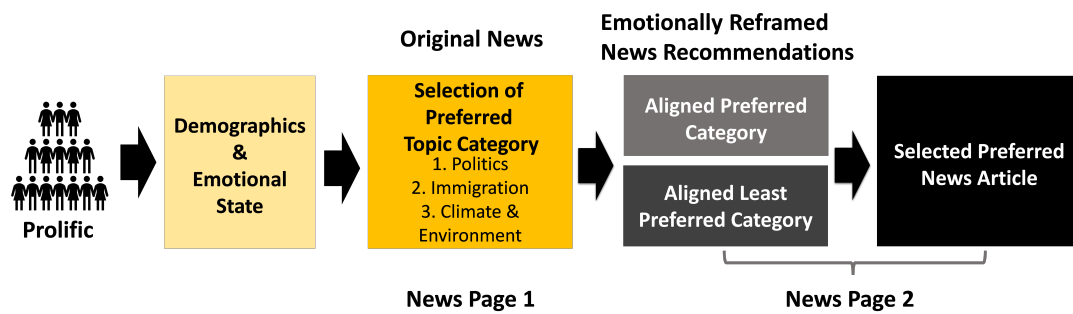
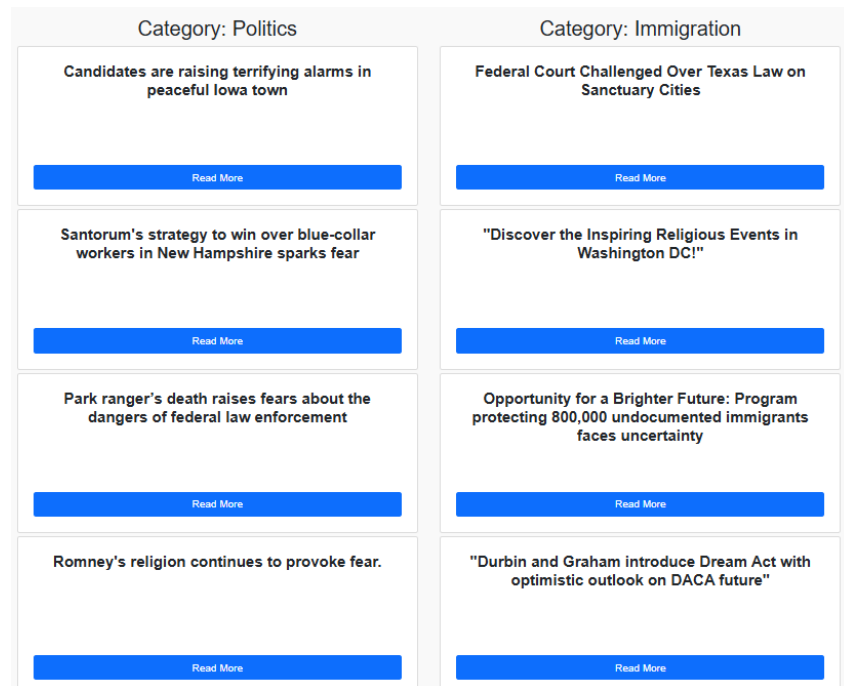**Figure 1:** Participant flow in the user experiment.

Figure 2: Example of the news recommendation interface. It contains news articles from two different categories: Articles in one column were aligned with the user's preferences (i.e., most preferred category), and one misaligned with the user's preferences (i.e., least preferred category). In the aligned condition, preferred news articles would be reframed to an emotional tone that was aligned with the user's current emotional state. This would be the opposite in the misaligned condition.

3.4. Measures

Selection of news article was measured by asking participants to select their favorite article after reading all the articles. This also served as an indirect indicator of selective exposure, especially when a user selected an article from their least preferred topic category.

Key independent variables included emotional alignment (match vs. mismatch between the article's emotional tone and the user's self-reported emotional state) and category preference (preferred vs. least preferred topic).

Engagement was assessed using two indicators: (1) reading time per article, used as a proxy of attention and content processing depth, and (2) click behavior, reflecting users' immediate interest in a headline or topic.

3.5. Ethical Statement

This research adhered to the ethical guidelines of the University of Bergen and the Norwegian guidelines regulations for scientific research. The study was judged to meet the ethical standards of the University of Bergen and therefore did not require a more extensive review, as it contained no misleading information, stressful tasks, or content that would likely provoke extreme emotions. All collected data were collected and processed anonymously to ensure participant confidentiality and privacy. For future applications, emotion-aware recommenders should ensure transparency (e.g., notifying users of emotional adaptation) and user control (e.g., opt-out options) to support ethical personalization.

4. Results

This section presents the results of the study, organized by research question. We examine how emotional framing and emotional alignment influence user selection of the news article and engagement with the news recommender system. All statistical models include both main effects and interaction effects, with a particular focus on whether emotional alignment increases the openness to content from categories that are the least preferred by users. Engagement was assessed through user behavior, including time spent reading and clicking behavior.

4.1. Emotional Alignment and News Article Preferences (RQ1)

To answer this question, we performed a logistic regression with the selection of a favorite article as the dependent variable. The reference category (baseline) was set to articles that were both emotionally misaligned and from the user's least preferred category. The remaining three combinations, emotionally aligned and least preferred, emotionally misaligned and preferred, and emotionally aligned and preferred, were entered as predictors.

The results in Table 1 showed that all three alternative conditions significantly increased the likelihood of an article being selected as the favorite compared to the baseline. In particular, emotionally aligned articles from the user's preferred category had the strongest effect ($p < .001$, OR = 9.4), meaning users were over 9 times more likely to select such an article compared to the misaligned + least preferred baseline. Emotionally aligned articles in the least preferred category also showed a strong effect ($p < .05$, OR = 3.82), suggesting that emotional alignment tripled the odds of article selection even in categories users typically avoid. Moreover, emotionally misaligned articles in preferred categories increased odds by more than sevenfold ($p < .001$, OR = 7.38). These results indicate that emotional alignment has a meaningful impact on user behavior, especially when combined with topic preference.

However, one of the most important findings is that even when emotional alignment was applied to a user's least preferred topic, the likelihood of that article being chosen as favorite still increased significantly relative to the baseline. This specific condition demonstrates that emotional personalization alone, without topical interest, can positively affect the selection of a news article. It suggests that emotional alignment has the potential to overcome users' initial disinterest in certain topics by making the content feel more emotionally resonant. While prior research has shown that affective cues can influence reading preferences in news contexts [?], our study builds on this work by showing that aligning the article's emotional tone with the user's current emotional state can increase the likelihood of selecting news content they would typically avoid.

In an additional analysis, we tested whether emotional alignment and category preference each had their own effect on which article users chose as their favorite (see results in Table 2). Both variables were statistically significant predictors ($p < .05$), confirming that emotional and topical alignment each contribute to positive impact on selection of news article. These results build on prior research demonstrating that Large Language Models (LLMs) can effectively reframe news content and shape readers' emotional responses [13, 43, 42], while also showing that emotional alignment can directly influence user choice. The findings also align with evidence that user interest is a consistent driver of engagement, regardless of emotional valence [53].

Table 1

Logistic regression predicting favorite article selection. Reference group: *Emotionally Misaligned + Least Preferred Category*.

Group	Coefficient (β)	p-value	Odds Ratio
Emotionally Aligned + Preferred Category	2.240	$< .001$	9.40
Emotionally Aligned + Least Preferred Category	1.341	.015	3.82
Emotionally Misaligned + Preferred Category	1.999	$< .001$	7.38
Pseudo R^2			0.077

In summary, the results suggest that emotional personalization is not merely a supplementary feature but may play a distinct and impactful role in recommender systems, particularly in promoting exposure to content users might otherwise overlook.

Table 2

Logistic regression model predicting the likelihood of a participant selecting an article as their favorite. The baseline condition includes all articles that are not emotionally aligned or not in the participant's preferred category.

Variable	Coefficient (β)	p-value	Odds Ratio
Emotionally Aligned	0.490	0.0366	1.63
Category Preferred	1.336	$< .001$	3.80
Pseudo R^2 Emotional Alignment Model			0.010
Pseudo R^2 Category Alignment Model			0.060

4.2. Emotional Framing and User Engagement (RQ2)

To investigate this question, we examined whether certain emotional frames were more effective in increasing engagement with users' least preferred content categories. Two main analyses were conducted: a one-way ANOVA to test differences in engagement based on emotional tone (hope, fear, anger), and logistic regression to model click behavior across emotional tone and category preference.

Table 3

Tukey HSD test comparing mean time spent reading articles framed with different emotions (Angry, Fearful, Hopeful).

Group 1	Group 2	Mean Diff.	p-adj	Lower	Upper
Angry	Fearful	-9.255	0.1824	-21.5838	3.0738
Angry	Hopeful	-12.4179	0.0379	-24.2896	-0.5462
Fearful	Hopeful	-3.1629	0.7504	-13.4680	7.1421

4.2.1. Time spent on news articles

The ANOVA analysis focused on time spent reading articles and revealed a statistically significant main effect of emotional tone ($p < .05$). The post hoc Tukey tests showed that articles framed with anger led to significantly longer reading times than those framed with hope ($p = 0.0379$) (see Table 3). Fearful articles also showed an increase in reading time compared to hopeful articles, although the difference was not statistically significant. This pattern suggests that negative emotional tones, particularly anger, enhance user attention and engagement.

These results are particularly important when considering articles from users' least preferred categories. The extended reading time for angry articles, regardless of topic, indicates that certain emotional tones can help overcome topic aversion and draw users into content they would otherwise ignore. This aligns with previous research that users often favor negatively framed content, even when it does not match their stated interests [54]. It also aligns with evidence that anger is an emotion capable of directing attention and engagement [19, 34].

4.2.2. Clicks on news articles

To further analyze user engagement, we conducted three separate logistic regressions to predict click behavior based on emotional tone. Each emotional condition (Fearful, Hopeful, Angry) was tested independently using a binary dummy variable: coded as 1 if the article was framed with that specific emotion, and 0 otherwise. This allowed us to isolate the effect of each emotional tone by comparing it against all other conditions combined. Table 4 summarizes the results.

The model showed that fearfully framed articles significantly increased the likelihood of being clicked ($\beta = 0.365$, $p = .001$, OR = 1.44), indicating that the odds of clicking were 44% higher compared to articles with other emotional framings. In contrast, hopefully framed articles significantly reduced click likelihood ($\beta = -0.301$, $p = .004$, OR = 0.74), meaning users had 26% lower odds of clicking. Articles framed with anger did not show a statistically significant effect on clicks. These findings confirm that emotional tone influences user interaction: fearful content appears to capture user attention more effectively, while hopeful framing may reduce immediate engagement.

In summary, previous research has shown that negative emotional framework can alter reader emotional states [13], our findings extend this by demonstrating that it also influences user behavior. In our study, angry framing led to longer reading times, while fearful framing increased the likelihood of article clicks, highlighting the distinct behavioral effects of different negative emotions.

Table 4
Three separate logistic regression models predicting click behavior for each emotional framing. Each emotional tone (e.g., Fearful) was tested in a separate binary model using dummy coding (1 = article framed with the target emotion, 0 = articles framed with the other emotions). The reference group in each model consists of articles not framed with the target emotion.

Emotion	Coefficient (β)	p-value	Odds Ratio
Fearful	0.365	0.001	1.44
Hopeful	-0.301	0.004	0.74
Angry	-0.033	0.797	0.97
Pseudo R^2 (Fearful Model)			0.005
Pseudo R^2 (Hopeful Model)			0.004
Pseudo R^2 (Angry Model)			0.000

5. Discussion

The results of this study demonstrate that both emotional alignment and emotional framing significantly shape user behavior in the context of news consumption. By examining how users' self-reported emotional states interact with emotionally reframed articles across preferred and non-preferred topics, this research provides new insights into how news recommender systems can be designed to balance personalization with exposure to diverse content.

Regarding [RQ1], the emotional alignment between the self-reported emotional states of the users and the emotional tone of the article significantly increased the likelihood of article selection. Notably, this effect extended to articles drawn from users' least preferred topics, indicating that emotional congruence may override topical disinterest. This finding is important for recommender system design, as it suggests that emotional personalization could help mitigate selective exposure by encouraging users to be exposed to content outside their pre-existing preference. These results extend previous research showing that the GPT-based emotional framework has the potential to promote prosocial behavior [7], and our findings further demonstrate that combining GPT-based emotional framing with user emotion alignment, as implemented in our study, ultimately, to reduce selective exposure and social polarization.

In terms of [RQ2], the emotional tone of the articles, regardless of user alignment, affects user engagement. Anger-framed articles led to significantly longer reading times than hopeful ones, and fear-based framing showed higher click rates overall. These findings are consistent with previous work that identified fear and anger as high-arousal emotions that capture attention and drive cognitive engagement [18, 19, 34]. Hope, in contrast, may foster longer-term motivation, but appears less effective in capturing immediate attention on digital news interfaces.

These patterns demonstrate the potential of emotion-aware recommendation to subtly shift user behavior without overtly pushing polarizing or oppositional content. Rather than forcing exposure to dissonant content, an emotion-aware approach could act as a bridge, increasing receptiveness through emotional resonance.

However, this potential comes with ethical responsibility. Emotional framing, particularly with high-arousal emotions such as anger or fear, may risk sensationalism or manipulation if not applied transparently. System designers must ensure that emotional personalization is implemented in a way that informs the reader rather than merely exploiting emotional responses for clicks or retention. This study also underscores the complexity of user interaction with emotionally framed content. While alignment increased openness to less preferred topics, the effectiveness of specific emotional tones varied. Negative emotions, such as anger, elicited stronger engagement compared to positive emotions, such as hope.

In sum, this study contributes to growing research at the intersection of affective computing and news recommender systems. It underscores the importance of considering users' emotional context in system design and emphasizes how emotional framing can be both a technical tool and a meaningful design choice for improving diversity and uphold user engagement in digital news platforms.

5.1. Limitations and Future Work

Despite encouraging findings, this study has a few limitations. First, images were excluded from all articles to ensure consistency and isolate the effects of emotional tone in the textual content. This decision was partly due to limitations of AI-generated images, which often exhibit visual artifacts such as distorted faces or random text. Prior research also highlights that images can significantly influence emotional perception and user engagement [55, 14, 56]. Second, emotional states were measured only once at the beginning of the session and not assessed again, which limits the ability to capture emotional shifts during interaction. Third, the sample was limited to U.S. participants recruited online, which may affect the generalizability of the findings to other populations. Finally, this study did not investigate long-term user behavior or the sustained effects of emotional framing.

Future work could address current limitations in several ways. First, integrating images alongside

emotionally reframed text may reveal how visual and textual cues interact. Next, future research could examine a wider range of emotional tones and track users' emotional states at multiple stages to better understand how emotional personalization shapes behavior. Moreover, recruiting more culturally diverse samples to explore how emotional framing is interpreted across contexts. Finally, longitudinal field studies, such as through partnerships with news providers in the United States or Norway, may offer insight into the long-term impact of emotion-aware recommender systems on engagement and content diversity.

6. Declaration on Generative AI

During the preparation of this work, the author(s) used ChatGPT for the following purposes: grammar and spelling check, and paraphrasing and rewording. In addition, ChatGPT was used as part of the news framing research experiment, which constitutes the core scientific contribution of this work. After using this tool, the author(s) reviewed and edited the content as needed and take full responsibility for the publication's content.

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References

[1] C. Trattner, D. Jannach, E. Motta, I. Costera Meijer, N. Diakopoulos, M. Elahi, A. L. Opdahl, B. Tessem, N. Borch, M. Fjeld, et al., Responsible media technology and ai: challenges and research directions, AI and Ethics 2 (2022) 585–594.

[2] D. Jannach, M. Jugovac, Measuring the business value of recommender systems, ACM Transactions on Management Information Systems (TMIS) 10 (2019) 1–23.

[3] C. A. Gomez-Uribe, N. Hunt, The netflix recommender system: Algorithms, business value, and innovation, ACM Transactions on Management Information Systems (TMIS) 6 (2015) 1–19.

[4] M. Elahi, D. Jannach, L. Skjærven, E. Knudsen, H. Sjøvaag, K. Tolonen, Ø. Holmstad, I. Pipkin, E. Throndsen, A. Stenbom, et al., Towards responsible media recommendation, AI and Ethics (2022) 1–12.

[5] F. Garcin, B. Faltings, O. Donatsch, A. Alazzawi, C. Bruttin, A. Huber, Offline and online evaluation of news recommender systems at swissinfo. ch, in: Proceedings of the 8th ACM Conference on Recommender systems, 2014, pp. 169–176.

[6] A. C. Niloy, S. Akter, N. Sultana, J. Sultana, S. I. U. Rahman, Is chatgpt a menace for creative writing ability? an experiment, Journal of Computer Assisted Learning 40 (2024) 919–930.

[7] J. H. Jeng, G. Kasangu, A. Starke, K. M. A. Seddik, C. Trattner, The role of gpt as an adaptive technology in climate change journalism, in: Proceedings of the 33rd ACM Conference on User Modeling, Adaptation and Personalization, 2025, pp. 214–223.

[8] K. M. A. Seddik, E. Knudsen, D. Trilling, C. Trattner, Understanding how news recommender systems influence selective exposure, in: RecSys' 23: Proceedings of the 17th ACM Conference on Recommender Systems, CEUR, 2023.

[9] S. Knobloch-Westerwick, J. Meng, Looking the other way: Selective exposure to attitude-consistent and counterattitudinal political information, Communication Research 36 (2009) 426–448.

[10] J. H. Jeng, Bridging viewpoints in news with recommender systems, in: Proceedings of the 18th ACM Conference on Recommender Systems, 2024, pp. 1283–1289.

[11] E. Pariser, The filter bubble: How the new personalized web is changing what we read and how we think, Penguin, 2011.

[12] E. Bakshy, S. Messing, L. A. Adamic, Exposure to ideologically diverse news and opinion on facebook, Science 348 (2015) 1130–1132.

[13] J. H. Jeng, G. Kasangu, A. Starke, C. Trattner, Emotional reframing of economic news using a large language model, in: Adjunct Proceedings of the 32nd ACM Conference on User Modeling, Adaptation and Personalization, 2024, pp. 231–235.

[14] J. H. Jeng, G. A. B. Kasangu, A. D. Starke, E. Knudsen, C. Trattner, Negativity sells? using an llm to affectively reframe news articles in a recommender system, in: ACM Conference on Recommender Systems (RecSys' 24), 2024.

[15] J. Mizgajski, M. Morzy, Affective recommender systems in online news industry: how emotions influence reading choices, User Modeling and User-Adapted Interaction 29 (2019) 345–379.

[16] C. Merrefield, Readers of online news prefer simple headlines, research suggests. journalists? not so much., https://journalistsresource.org/media/simple-headlines-online-news-readers/, 2024. Accessed: 12-05-2025.

[17] Q. V. Liao, W.-T. Fu, S. S. Mamidi, It is all about perspective: An exploration of mitigating selective exposure with aspect indicators, in: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems, 2015, pp. 1439–1448.

[18] K. Witte, Putting the fear back into fear appeals: The extended parallel process model, Communications Monographs 59 (1992) 329–349.

[19] J. Pligt, M. Vliek, The Psychology of Influence: Theory, research and practice, Routledge, 2016.

[20] H. C. Lench, N. T. Reed, T. George, K. A. Kaiser, S. G. North, Anger has benefits for attaining goals., Journal of Personality and Social Psychology (2023).

[21] S. W. Webster, B. Albertson, Emotion and politics: Noncognitive psychological biases in public opinion, Annual Review of Political Science 25 (2022) 401–418.

[22] N. Geiger, K. Gasper, J. K. Swim, J. Fraser, Untangling the components of hope: Increasing pathways (not agency) explains the success of an intervention that increases educators' climate change discussions, Journal of Environmental Psychology 66 (2019) 101366.

[23] J. Macy, C. Johnstone, Active hope (revised): How to face the mess we're in with unexpected resilience and creative power, New World Library, 2022.

[24] C. R. Snyder, Hope theory: Rainbows in the mind, Psychological inquiry 13 (2002) 249–275.

[25] D. Jannach, P. Pu, F. Ricci, M. Zanker, Recommender systems: Past, present, future, AI Magazine 42 (2021) 3–6.

[26] P. Resnick, N. Iacovou, M. Suchak, P. Bergstrom, J. Riedl, Grouplens: An open architecture for collaborative filtering of netnews, in: Proceedings of the 1994 ACM Conference on Computer Supported Cooperative Work, 1994, pp. 175–186.

[27] R. Burke, A. Felfernig, M. H. Göker, Recommender systems: An overview, AI Magazine 32 (2011) 13–18.

[28] S. Raza, C. Ding, News recommender system: a review of recent progress, challenges, and opportunities, Artificial Intelligence Review (2022) 1–52.

[29] GeeksforGeeks, Collaborative filtering in machine learning, https://www.geeksforgeeks.org/collaborative-filtering-ml/, 2024. Accessed 12-05-2024.

[30] V. Dey, Collaborative filtering vs. content-based filtering for recommender systems, https://analyticsindiamag.com/ai-mysteries/collaborative-filtering-vs-content-based-filtering-for-recommender-systems/, 2021. Accessed 12-05-2025.

[31] M. Uta, A. Felfernig, V.-M. Le, T. N. T. Tran, D. Garber, S. Lubos, T. Burgstaller, Knowledge-based recommender systems: overview and research directions, Frontiers in Big Data 7 (2024) 1304439.

[32] A. Felfernig, R. Burke, Constraint-based recommender systems: technologies and research issues, in: Proceedings of the 10th International Conference on Electronic Commerce, 2008, pp. 1–10.

[33] F. Lorenzi, F. Ricci, Case-based recommender systems: A unifying view, in: IJCAI Workshop on Intelligent Techniques for Web Personalization, Springer, 2003, pp. 89–113.

[34] A. J. Lambert, F. R. Eadeh, E. J. Hanson, Anger and its consequences for judgment and behavior: Recent developments in social and political psychology, Advances in Experimental Social

Psychology 59 (2019) 103–173.

[35] E. Oldfield, Corporations vs. consumers: Who is really to blame for climate change, https://sites.manchester.ac.uk/global-social-challenges/2022/07/07/corporations-vs-consumers-who-is-really-to-blame-for-climate-change/, 2022. Accessed 12-05-2025.

[36] R. M. Entman, Framing: Toward clarification of a fractured paradigm, Journal of communication 43 (1993) 51–58.

[37] S. T. Fiske, S. E. Taylor, Social cognition, Mcgraw-Hill Book Company, 1991.

[38] D. Tewksbury, D. A. Scheufele, News framing theory and research, in: Media effects, Routledge, 2009, pp. 33–49.

[39] C. H. De Vreese, News framing: Theory and typology, Information Design Journal + Document Design 13 (2005) 51–62.

[40] M. Maiese, R. Hanna, The mind-body politic, Springer, 2019.

[41] R. Coleman, S. Banning, Network tv news' affective framing of the presidential candidates: Evidence for a second-level agenda-setting effect through visual framing, Journalism & Mass Communication Quarterly 83 (2006) 313–328.

[42] T. Greenaway, K. S. Fielding, Positive affective framing of information reduces risk perceptions and increases acceptance of recycled water, Environmental Communication 14 (2020) 391–402.

[43] M. Sanford, M. Witkowska, R. Gifford, M. Formanowicz, Emotional framing in online environmental activism: Pairing a twitter study with an offline experiment, Frontiers in Psychology 13 (2023) 1099331.

[44] L. Festinger, A theory of cognitive dissonance, volume 2, Stanford university press, 1962.

[45] P. Williams, M. L. Kern, L. Waters, Exploring selective exposure and confirmation bias as processes underlying employee work happiness: An intervention study, Frontiers in Psychology 7 (2016) 878.

[46] M. A. Beam, Automating the news: How personalized news recommender system design choices impact news reception, Communication Research 41 (2014) 1019–1041.

[47] M. Alam, A. Iana, A. Grote, K. Ludwig, P. Müller, H. Paulheim, Towards analyzing the bias of news recommender systems using sentiment and stance detection, in: Companion Proceedings of the Web Conference 2022, 2022, pp. 448–457.

[48] S. Kalyanaraman, S. S. Sundar, The psychological appeal of personalized content in web portals: Does customization affect attitudes and behavior?, Journal of Communication 56 (2006) 110–132.

[49] S. Flaxman, S. Goel, J. M. Rao, Filter bubbles, echo chambers, and online news consumption, Public Opinion Quarterly 80 (2016) 298–320.

[50] J. Dennison, Using emotions in migration policy communication, Technical Report, International Centre for Migration Policy Development (ICMPD), 2023.

[51] T. A. Myers, C. Roser-Renouf, E. Maibach, Emotional responses to climate change information and their effects on policy support, Frontiers in Climate 5 (2023) 1135450.

[52] OpenAI, Gpt-4o: A step towards more natural human-computer interaction, https://openai.com/index/hello-gpt-4o/, 2024. Accessed 14-05 -2025.

[53] M. Mousoulidou, L. Taxitari, A. Christodoulou, Social media news headlines and their influence on well-being: emotional states, emotion regulation, and resilience, European journal of investigation in health, psychology and education 14 (2024) 1647–1665.

[54] M. Trussler, S. Soroka, Consumer demand for cynical and negative news frames, The International Journal of Press/Politics 19 (2014) 360–379.

[55] M. Alpuim, K. Ehrenberg, Why images are so powerful—and what matters when choosing them, Bonn Institute 3 (2023).

[56] A. Karduni, R. Wesslen, D. Markant, W. Dou, Images, emotions, and credibility: Effect of emotional facial images on perceptions of news content bias and source credibility in social media, arXiv preprint arXiv:2102.13167 (2021).