# Why Maps are More Favored Visuals in Climate Change Newsfeeds on Social Media? Exploring the Influence of User Characteristics

Nianhua Liu [1], Yu Feng [1], and Liqiu Meng [1]

[1] Chair of Cartography and Visual Analytics, Technical University of Munich, Munich, Germany

Correspondence: Nianhua Liu (nianhua.liu@tum.de)

**Abstract.** Social media is a key platform for climate change communication. However, it remains a challenge to attract audiences effectively. This study examines user preferences for different visual formats in climate-related posts and explores how user characteristics influence these preferences. A user experiment with 60 participants tested three formats: headline-with-map, headline-with-photo, and headline-only. Participants indicated their preference by selecting "More" or "Less" for each post. Results show a clear preference for headline-with-map posts, which also outperformed other visual formats in efficiency, aesthetics, and comprehension. While user characteristics had minimal influence on headline-with-map, they significantly shaped preferences for headline-only posts such as experience with climate change, trust in climate information, and interest in climate. These findings highlight the critical role of maps in improving engagement and comprehension in climate communication.

**Submission Type.** Analysis

**BoK Concepts.** [CV6] Usability of maps, [TA11] User community of EO services and applications

**Keywords.** user characteristics, maps, climate communication, social media

## 1 Introduction

Social media has emerged as a key platform for people to access information about climate change in their daily lives, such as Twitter (Stier et al., 2017; Veltri and Atanasova, 2017). It is also widely used by experts and institutions to disseminate insights and share research about climate change.

However, efficient climate communication remains challenging, such as identifying factors that attract audiences on social media (Moser, 2010) and tailoring audience segmentation strategies for climate change communications (Bostrom et al., 2013).

Social media newsfeed posts can be likened to "snacks" of information, offering users quick summaries as they scroll through their feeds (Costera Meijer and Groot Kormelink, 2015). As a result, users often rely on fast-thinking processes when viewing these posts, making responses effortlessly, guided by their intuition and past experiences (Kahneman, 2011).

Previous studies have shown the significant potential for exploring the visual communication of climate change through social media (Pearce et al., 2019). Visual media, including maps, infographics, and images, all fall within the research framework of "climate visuals" (O'Neill and Smith, 2014). Empirical research shows that posts with positive images capture more visual attention than those with negative or no images, leading to more likes and shares (Keib et al., 2018). Maps are a key tool for communicating climate change, as they can engage readers, simplify complex information, and make the issue more tangible (Fish, 2020). On social media, newsfeed posts with richer content, such as images, have been found to increase user engagement and fixation compared to text-only posts. (Vraga et al., 2016).

Despite extensive research on visual communication related to climate change, user characteristics are often treated as control variables. However, without a deeper understanding of user characteristics in the cognition of climate-related posts on social media, it is difficult to develop customized climate communication strategies for different user groups (Bostrom et al., 2013).

In the context of online news, personal interest often plays a more significant role in selecting which posts to read than the perceived importance of the story itself (Yang, 2016). A panel study found that personal interest was one of the key factors in choosing which posts to engage with (Brosius and Unkel, 2016).

Previous research has explored the effects of perceived involvement on users' attitudes toward climate-related information (Taddicken, 2013). When users have high interest and personal involvement in a topic, they are more likely to engage more with the posts (Pee, 2012). Additionally, students' interest in climate change has been positively linked to their knowledge of the issue (Carman et al., 2021).

Experience with climate change and personal relevance can also influence users' cognition of social media posts (Pee, 2012). Similarly, local messages have been shown to be strong predictors of climate change engagement, highlighting the role of personal experience in shaping user attitudes (Scannell and Gifford, 2013). User expertise also plays a significant role in how online information is perceived. Technologically knowledgeable users are more likely to critically evaluate posts when encountering related content (Wathen and Burkell, 2002).

While these user characteristics influence the cognition of social media content, it is valuable to explore how they affect preferences for the visuals in climate-related posts on social media. Our user experiment examined the preference of climate change posts and answered three research questions:

- Which visual formats do users prefer to see more or less?
- Which user characteristics can influence users' preferences for the visual formats, and how do they exert their influence?
- How do different visual formats affect users' cognition of climate-related posts?

## 2 Method

### 2.1 Participants and Interface

60 participants (female: 24, male: 36) aged from 18 to 34 voluntarily took part in the experiment. The tablet device employed in this experiment was the iPad Pro 4th generation. The user interface for this experiment was developed using an open-source online testing platform that simulates social media components (Butler et al., 2023). A feed mode was used to display all posts on a single page, allowing users to scroll down to view the entire list of posts. Figure 1 provides screenshot example of this setup.
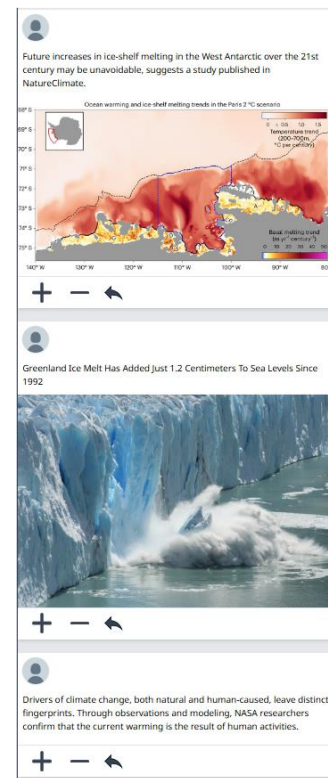


**Figure 1.** An example of three visual formats in feed mode.

The posts were presented in three visual formats, including headline-with-map, headline-with-photo, and headline-only. Research has shown that social media endorsements, such as likes, influence the selection of news posts (Dvir-Gvirsman, 2019).

To simulate this engagement mechanism more concretely, participants were required to make a binary selection—either "More" or "Less"—for each post, represented by a plus or minus symbol (as shown in Figure 1). Selecting "More" indicated a preference for seeing more of that type of post, while "Less" represented a preference for seeing fewer posts of that type. This forced-choice design ensured that every post received a response, capturing user preferences systematically.

### 2.2 Experimental Procedure

Figure 2 illustrates the overall experimental process. Participants were informed that all collected data would be anonymized and used solely for research purposes. Each participant provided written informed consent before taking part in the study.

At the beginning of the experiment, participants completed a pre-experiment questionnaire consisting of eight items measured on a 5-point Likert scale to assess user characteristics: *Interest in Maps* (*IM*), *Proficiency in Creating Maps* (*PM*), *Frequency Encounter Maps on Social Media* (*FM*), *Emotionally Affected by Social Media*

(*EE*), *Experienced Consequence of Climate* (*EC*), *Interest in Climate* (*IC*), *Trust Climate Information on Social Media* (*TC*) and *Well-informed about Climate* (*WI*).

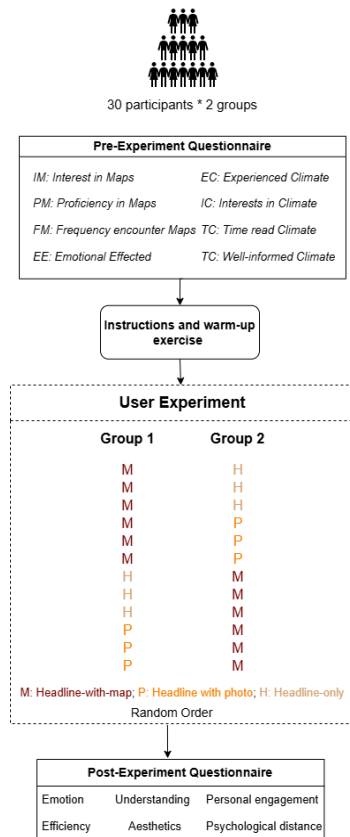Then, participants took part in an introductory session that



**Figure 2.** Overall experimental process.

included instructions and a warm-up exercise to familiarize them with the task.

This study employed a mixed experimental design, incorporating both within-group and between-group elements. In the between-group design, each participant was randomly assigned to one of two groups, allowing for a controlled comparison of visual formats using the same headline content. This random assignment ensured that any differences in user traits between groups occurred by chance alone. Within each group, participants were shown twelve posts, including six headline-with-map posts, three headline-with-photo posts, and three headline-only posts. Despite headline-with-map posts being shown more frequently overall, the comparisons of headline-with-map versus headline-with-photo and headline-with-map versus headline-only had equal representation across participants. Each pairwise comparison between visual formats remained balanced and directly comparable. The posts were presented in a randomized order.

After viewing the posts, participants completed a post-experiment questionnaire to evaluate how different visual formats influenced their cognition across six dimensions:

emotion, understanding, aesthetics, personal engagement, psychological distance, and efficiency. Responses were recorded on a five-point Likert scale, ranging from "Least or Worst" (1) to "Most or Best" (5).

## 2.3 Analysis Framework

Given that the data do not follow a normal distribution, non-parametric methods are employed for analysis, such as the Chi-Square test.

In our study, we first investigated whether preferences varied significantly across different visual formats. Then, we investigated how these preferences differed based on various user characteristics. To assess these relationships, we applied the Chi-Square Test for independence to compare the distribution of "More" and "Less" selections across different user characteristic values. If a significant difference was found, the Chi-Square Test for homogeneity was conducted to determine whether the percentage of participants selecting "More" varied significantly across the five-point Likert scale for each characteristic. When both tests indicated significance, we analyzed the selection trends to determine how user preferences for "More" or "Less" varied across different user characteristic values. This enabled us to assess whether certain characteristics consistently and differentially influenced the preference for viewing more or fewer climate-related posts. Additionally, a similar test was conducted for the "Less" option.

Afterward, we analyzed the five-point Likert scale results of the post-experiment questionnaire to examine how different visual formats influenced users' cognition of climate-related posts.

## 2.3 Data and Software Availability

The developed Open Educational Resources, including the data and code used in the provided examples and exercises, are published under a permissive CC-BY-SA 4.0 license and available at https://doi.org/10.17605/OSF.IO/2EXDP.
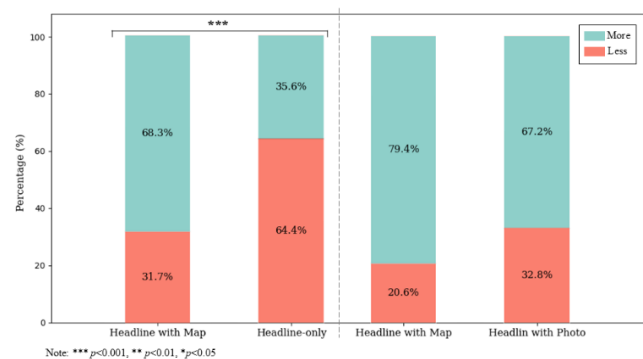


**Figure 3.** User preferences for visual formats.

# 3 Results

## 3.1 User Preferences for Visual Formats

First, the user preference for visual format is analyzed. Figure 3 illustrates the percentage of users selecting "More" or "Less" for different visual formats of climate-related posts. Headline-with-map posts received the higher preference in both comparison cases.

A Chi-Square test comparing headline-with-map and headline-only posts revealed a statistically significant difference ($\chi^2 = 20.23$, $p < 0.001$), indicating that users were significantly more inclined to view posts that included a map rather than text alone. However, the comparison between headline-with-map and headline-with-photo posts did not yield a statistically significant difference ($\chi^2 = 3.22$, $p = 0.073$), suggesting that while maps may have a slight advantage, their impact on user preference is not substantially different from that of photos.

## 3.2 Influence of User Characteristics on Visual Format Preferences

Next, user preferences for different visual formats, which vary depending on user characteristics are examined. Chi-Square tests for homogeneity and independence were employed.

The Chi-Square ($\chi^2$) statistic provides insight into the strength of association between categorical variables. A higher value indicates a greater difference in preferences across different levels. Conversely, a lower value suggests that preferences are more uniform across different levels.

### 3.2.1 Headline-with-Map versus Headline-only

For headline-with-map posts, the overall distribution of users selecting "More" or "Less" was not significantly different across all user characteristics. This indicates that user characteristics did not have a substantial influence on whether participants preferred to see more or less headline-with-map posts (Figure 4).

For headline-only posts, user preferences exhibited significant difference, in relation to *Experience with Climate Change* (*EC*), *Trust in Climate Information* (*TC*),
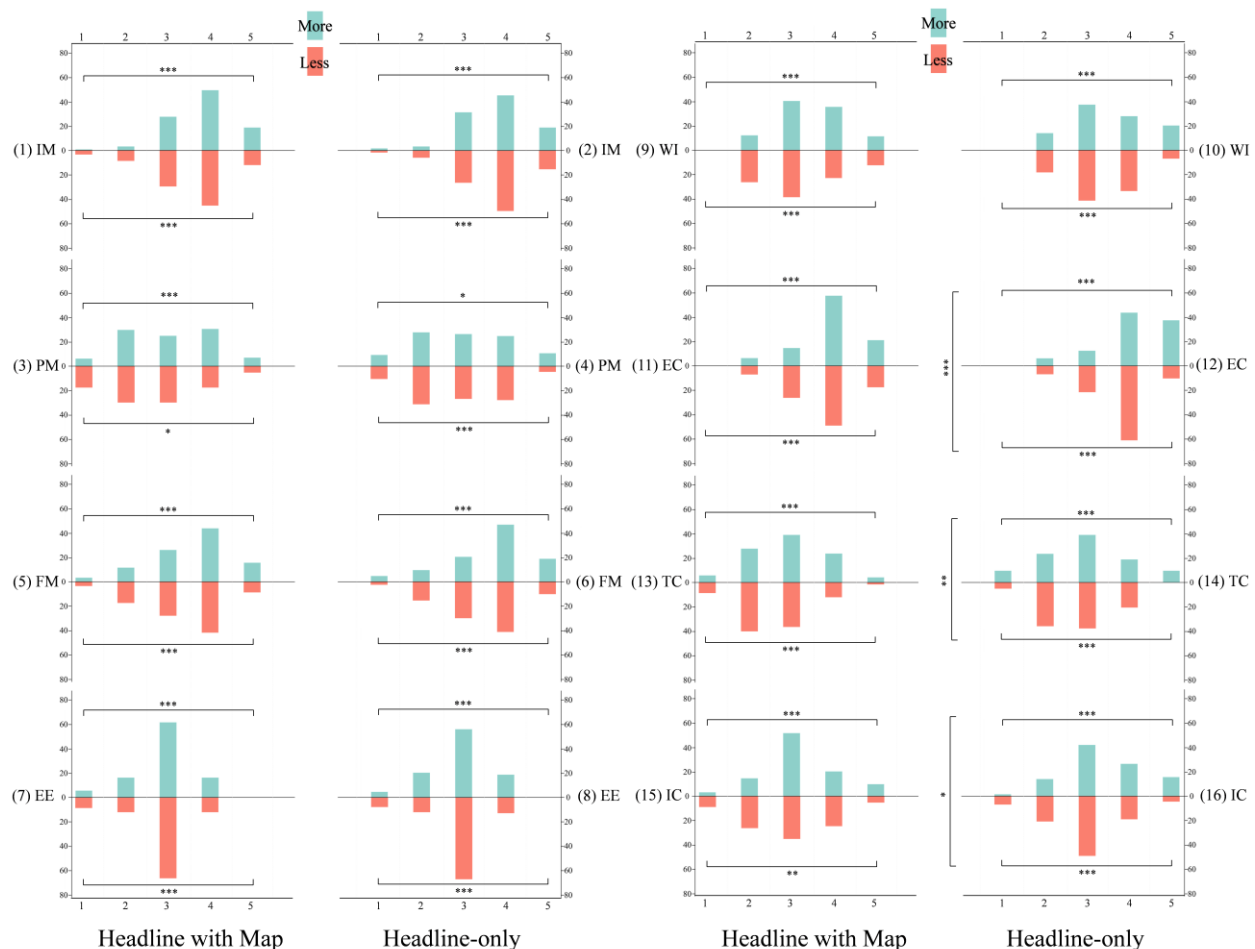


**Figure 4.** Distribution of preference between headline-with-map and headline-only across user characteristics.

and *Interest in Climate* (*IC*). Notably, the number of selections for "Less" (116) was nearly double that for "More" (64).

*EC* had the most pronounced effect, with a substantial difference between "More" ($\chi^2 = 48.12$, $p < 0.001$) and "Less" ($\chi^2 = 136.60$, $p < 0.001$) selections, resulting in a significant shift in the "More" vs. "Less" distribution ($\chi^2 = 19.29$, $p < 0.001$). *EC* reveals distinct differences in user preferences for "More" and "Less" selections across experience levels. Among users selecting "More," the largest proportion fell into "Agree" (43.75%), followed closely by "Strongly agree" (37.50%), indicating that individuals with moderate to high experience with climate change were more inclined to view the content. Conversely, those selecting "Less" were predominantly from "Agree" (61.21%), with a smaller proportion from "Strongly agree" (10.34%).

Similarly, *TC* showed a strong divergence in preference, with a significant variation in "More" ($\chi^2 = 19.28$, $p < 0.001$) and "Less" ($\chi^2 = 69.86$, $p < 0.001$) selections ($\chi^2 = 14.18$, $p < 0.01$). A unique pattern emerged among users who strongly agree with *TC*, where none selected "Less," while 9.38% selected "More."

*IC* also demonstrated a significant shift in the selection balance, although to a lesser extent than *EC* and *TC*. The difference between "More" ($\chi^2 = 29.75$, $p < 0.001$) and "Less" ($\chi^2 = 73.57$, $p < 0.001$) selections resulted in a significant "More" vs. "Less" distribution difference ($\chi^2 = 11.20$, $p < 0.05$). Users at higher interest levels (Select 4 and 5) showed a stronger preference for "More" selections, with 26.56% of "More" responses from very interested users (Select 4) and 15.63% from extremely interested users (Select 5). Conversely, only 18.97% of "Less" selections came from these two groups combined.

### 3.2.2 Headline with Map versus Headline with Photo

To examine how user preferences differed between headline-with-map and headline-with-photo posts, Chi-Square Tests were also conducted for homogeneity and independence across multiple user characteristics (see Figure 5).

In the analysis of *Proficiency in Creating Maps* (*PM*) in headline-with-map posts, "More" was selected 143 times, while "Less" was selected 37 times. The Chi-Square Test for independence revealed a significant difference between "More" and "Less" selections ($\chi^2 = 12.82$, $p < 0.05$). Users with beginner-level proficiency (Select 2)
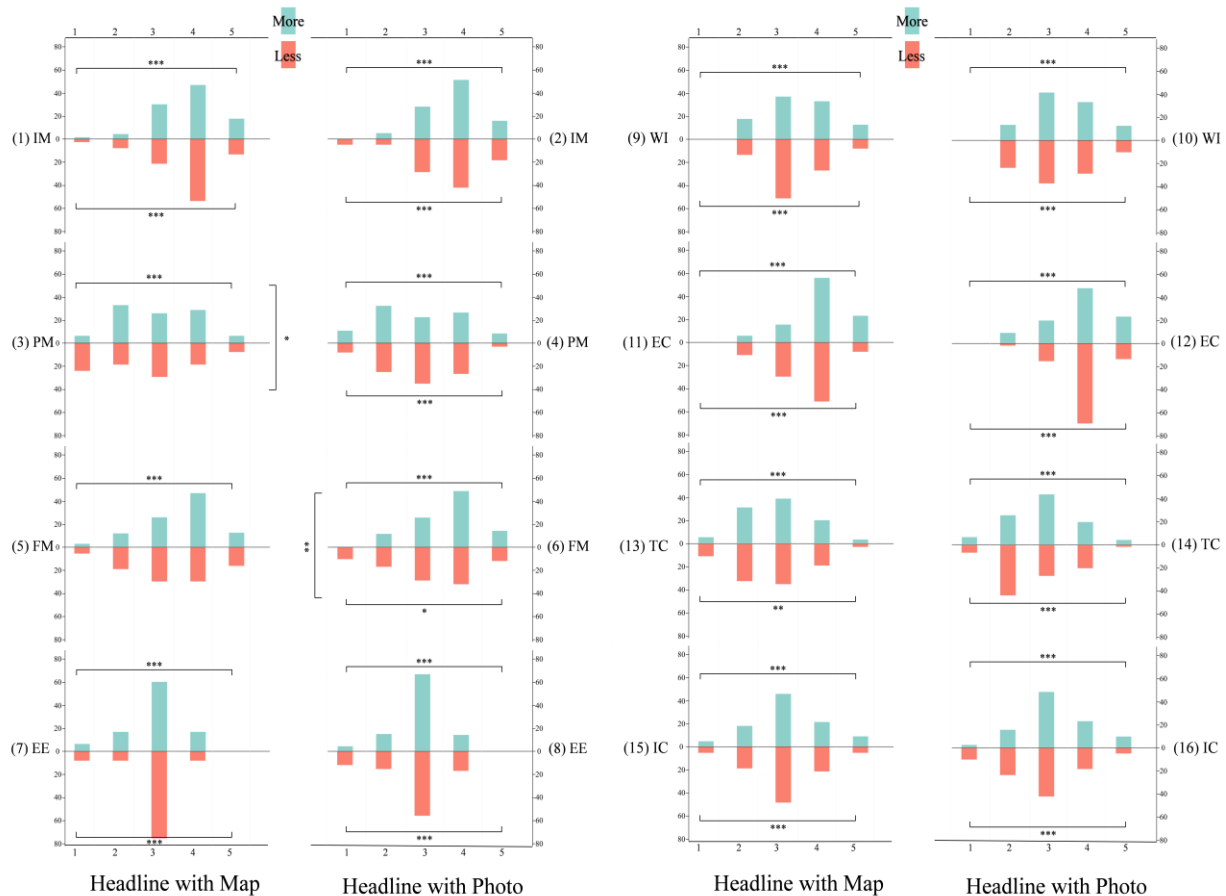


**Figure 5.** Distribution of preference between headline-with-map and headline-with-photo across user characteristics.

made up the largest proportion of "More" selections (32.87%). Intermediate (Select 3) and proficient users (Select 4) also comprised 25.87% and 28.67% of "More" selections, respectively. Conversely, the "Less" selections were more evenly distributed, which did not show a significant difference across five levels ($\chi^2 = 4.76$, $p = 0.31$). However, novice users (Select 1) were notably overrepresented in "Less" (24.32%).

For headline-with-photo posts, users clicked "More" a total of 121 times, while "Less" was selected 59 times. the Chi-Square Test for independence revealed a significant difference between the distribution of "More" and "Less" selections across *FM* values ($\chi^2 = 15.97$, $p < 0.01$). Users who encountered maps at least once a day (Select 4) were the group that would like to see more headline-with-photo posts, comprising nearly half (48.76%) of all "More" selections. The starkest contrast was seen in Select 1 (Never), where no users selected "More", yet 10.17% selected "Less".

### 3.3 The Influence of Visual Formats on User Cognition

The analysis reveals that different visual formats affect users' cognition of climate-related posts (Figure 6). To quantify these effects, participants rated their cognition across six dimensions using a five-point Likert scale, where higher scores indicate stronger or more positive responses. The average scores provide a comparative measure of how each visual format performs in influencing user cognition.

Headline-with-map posts consistently outperformed other formats across all cognitive dimensions. Efficiency emerged as the most distinctive cognitive dimension, with headline-with-map receiving an average score of 4.6, which is the highest among all cognitive dimensions.

Headline-with-map evokes stronger emotional responses (4.2 vs. 3.78 for headline-with-photo) and improves comprehension (4.28 vs. 3.95 for headline-with-photo). Similarly, maps were perceived as more visually appealing (4.45 vs. 4.13 for headline-with-photo) and more efficient (4.6 vs. 3.6 for headline-with-photo) than photos. Additionally, maps were most effective in reducing psychological distance (4.23).

## 4 Conclusion

This study examined user preferences for different visual formats in climate-related social media posts and explored which user characteristics influence these preferences, as well as how they exert their influence. Additionally, it investigated how different visual formats affect user cognition. As a show case on the role of visuals in climate communication, this study provides insight into why

headline-with-map posts received greater preference over other formats.

The results demonstrate a clear preference for headline-with-map posts, which were significantly more favored than headline-only posts. However, the preference between headline-with-map and headline-with-photo posts was not statistically significant.

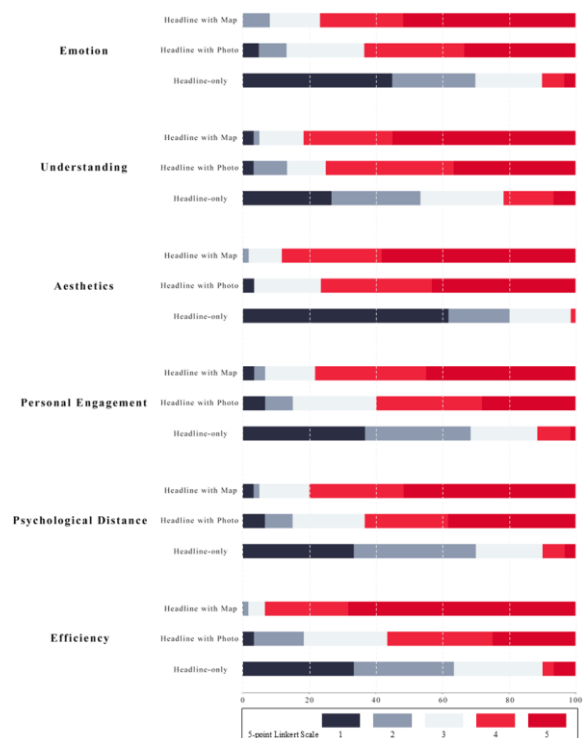Some user characteristics shape preferences for different



**Figure 6.** Post-experiment questionnaire results of visual formats on six users' cognition dimensions.

visual formats in climate-related social media posts. For headline-with-map posts, user characteristics did not have a substantial influence on whether participants preferred to see more or fewer posts, suggesting that maps maintain a broad appeal regardless of individual differences. Among all characteristics, *Proficiency in Creating map* (*PM*) was the only characteristics with a slight but notable impact on preference. Users with beginner to proficient mapping skills showed the strongest preference for maps, whereas those with no mapping experience were more likely to see less.

In headline-with-photo posts, *Frequency of Encountering Maps* (*FM*) influenced user preferences. Users frequently exposed to maps on social media were more inclined to see more climate-related photo content.

*Experience with Climate Change* (*EC*), *Trust in Climate Information* (*TC*), and *Interest in Climate* (*IC*) played crucial roles in headline-only posts. Users with strong climate change experiences were more likely to prefer seeing more posts. Similarly, trust in climate-related

information affected preference levels, with strong believers consistently choosing to see more climate-related content. Interest in climate topics also influenced preferences, with highly interested users being more inclined to view more posts.

Compared to headline-with-photo and headline-only posts, headline-with-map posts were marked to be the most effective visual format across all six cognitive dimensions. Their advantages were particularly pronounced in efficiency, aesthetics, and understanding, where users consistently rated maps higher. By enhancing comprehension and engagement while reducing psychological distance, maps help make climate issues feel more imminent and personally relevant to users.

Overall, these findings highlight the crucial role of visual formats - especially maps - in strengthening user cognition, engagement, and emotional connection in climate-related social media communication. Unlike other visual formats, maps maintain a broad appeal regardless of individual user characteristics, making them a universally effective tool for climate communication.

Moving forward, we plan to complement these findings with more objective measures of user attention and engagement, such as eye-tracking, to validate the stated preference for maps. Additionally, we intend to explore how user factors like trust in climate information intersect with these attention patterns – for instance, examining whether users with higher vs. lower trust engage differently with map visuals (Liu et al., 2024). By combining subjective preference data with eye-tracking insights, our future work will provide a more robust, objective confirmation of why maps are favored and how they influence user attention and trust.

**Declaration of Generative AI in writing**

The authors declare that they have used Generative AI tools in the preparation of this manuscript. Specifically, the AI tools were utilized for improving grammar and sentence structure, but not for generating scientific content, research data, or substantive conclusions. All intellectual and creative work, including the analysis and interpretation of data, is original and has been conducted by the authors without AI assistance.

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