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ISSN: 1751-2786 (Print) 1751-2794 (Online) Journal homepage: www.tandfonline.com/journals/rjop20

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To cite this article: Franciska Nowak, Karin Boczek & Leyla Dogruel (04 Nov 2026): Local Climate Change Reporting: Do Locality Framing and Interactive Maps Impact Risk Perception and Memory?, Journalism Practice, DOI: 10.1080/17512786.2026.2753549

To link to this article: https://doi.org/10.1080/17512786.2026.2753549

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Published online: 04 Nov 2026.

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JOURNALISM PRACTICE
https://doi.org/10.1080/17512786.2026.2753549

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Local Climate Change Reporting: Do Locality Framing and Interactive Maps Impact Risk Perception and Memory?

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ABSTRACT

Considering the impact of local journalism in the context of climate change, this research investigates how locality framing and interactive features as important elements of digital local journalism affect news audiences. We used an article on heavy rainfall with a map visualizing data to test how local versus national framing and interactive versus static maps influence risk perception, responsibility attribution, article memory, and enjoyment in a 2 × 2 between-subjects online experiment with 632 German participants. We found that locality framing had no significant influence on risk perception or responsibility attribution, nor did it interact with place attachment. Unexpectedly, interactive maps heightened risk exposure perceptions but had minimal effect on enjoyment and memory retention. These findings question assumptions about the effectiveness of localizing global issues like climate change in digital local journalism.

ARTICLE HISTORY
Received 14 January 2026
Accepted 19 October 2026

KEYWORDS
Local journalism; digital journalism; climate communication; data journalism; interactive maps; online experiment

Introduction

With the transition to digital, local journalism has undergone fundamental changes: The availability of new digital tools opens up new possibilities for storytelling (Jenkins and Nielsen 2018). New market entrants now provide information via social media for free (Hess and Waller 2017; Jenkins and Nielsen 2018). In democratic societies, however, local journalism remains significant: Critical local reporting holds local politicians accountable, especially by covering issues easily overseen by national media that primarily report on national politics (Abernathy 2020). Local journalism can render global topics as more comprehensible and appealing by reporting through a local frame that reduces the distance to global issues such as climate change (Brown et al. 2011).

Journalism's shift to the digital realm is complemented by new technologies that influence audience reception processes (Perreault and Ferrucci 2020). Local news rooms are frequently described as rather resistant against digital innovation resulting in a slower adoption of digital technologies and practices (Waschková Císařová 2024). While news outlets catering to a broader audience rely on specialized teams trained to

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deal with complex data sets and develop multimedia elements and visualizations from scratch, local news outlets have to work with comparatively little resources and draw back on free tools easy to handle (Stalph, Hahn, and Liewehr 2023). Digital local journalism is characterized by combining reporting through a local lens, e.g., locality framing, with new digital storytelling techniques such as interactive features. One example of a topical global issue with local effects is climate change. So far one body of research examines climate communication (Degeling and Koolen 2022), another strand of literature investigates the effects of multimedia and interactivity in journalism (Greussing, Kessler, and Boomgaarden 2020). Recent studies looked at digital journalism and climate reporting in combination (e.g., Hayes and O'Neill 2025). However, reporting on climate change as a complex and data-heavy issue is especially challenging for local news outlets. Locality framing and interactive features as elements of digital local journalism have only been studied separately. In our study, we combine both elements. Focussing on climate change reporting, we set out to investigate in a 2×2 between-subjects design whether and how locality framing and interactive features influence readers' perception of issue-related risks, attribution of responsibility, and memory of article content. As the topic of a news article presented, we chose risks of and precautions for heavy rainfall that represents an example of a locally visible consequence of climate change. Participants who were recruited from a specific geographical region in Germany were presented with one of four versions of the news article framed either locally or nationally, accompanied by either an interactive or static map.

Our research provides a starting point to further investigate the impact of local journalism in the digital era on the individual level. For climate change reporting, our results can inform decisions about the localization of the global issue. From a journalism practice perspective, our results encourage discussions on fruitful storytelling strategies in local newsrooms reporting on globally relevant topics such as climate change.

A Sense of Place: Local Journalism in the Digital Era

In the digital era, global interconnectedness and the shifting significance of places for individuals are realities that local journalism outlets must address. Local events are now more intertwined with global events, requiring reporting that considers interdependencies beyond local, regional, and even national boundaries (Hess and Waller 2014). Novel concepts of local journalism, such as Hess (2013) geo-social framework, stress the lasting relevance of locality despite global media trends. For an audience, a geographical location remains significant because individuals form an identity tied to a place, but connections to local areas become increasingly diverse: whether through living there, maintaining social ties, having family roots or nostalgic associations, or visiting the area for vacations. Local journalism must take these wider social spaces into account to stay influential in the digital world (Hess 2013). Within the geo-social framework, Hess (2013) ascribes local reporting the power to bridge the geographical distance to a topic by interpreting the topic's local relevance. For example, when an Australian news outlet reports on a volcanic eruption in Iceland by discussing risks and consequences of similar events in the Australian region (Hess 2013). Local reporting as such addresses a reader's "sense of place" (Massey 1994) by including local place-mentions, prominent positioning and further references such as citing local experts (Buchanan

2009). Massey's (1994) "sense of place" concept thereby defines places beyond geographical boundaries as socially constructed with geographical roots.

We use the term "locality" to primarily account for the geographical aspects of local journalism practices contributing to an individual's sense of place. For audiences of local journalism outlets, a locale becomes visible in reporting through locality framing (Degeling and Koolen 2022; Entman 1993). We understand and use locality framing based on Buchanan's (2009) ideas focusing on place-mentions, citing local experts and further local references. Locality framing is especially important to bridge the psychological distance when local news rooms report on national or international topics. Our study investigates this practice using the example of heavy rainfall to demonstrate the application of locality framing in climate coverage.

Climate Change in Local Journalism: Reporting on a Global Topic Through a Local Lens

Anthropogenic climate change is one of the biggest threats humanity is facing (Moser 2010). Due to the societal relevance, complexity, and abstraction inherent to anthropogenic climate change (Akerlof et al. 2013; Hornsey et al. 2016), an extensive body of research has investigated strategies for effective communication (Feinberg and Willer 2011; Schäfer and Painter 2021; Thomas-Walters et al. 2024). To address these communicative challenges, environmental communication literature frequently utilizes the concept of psychological distance, which captures an individual's subjectively perceived distance to an event across spatial, social, temporal, and hypothetical dimensions (Loy and Spence 2020; Trope and Liberman 2010). While Brügger (2020) cautions against misapplying the concept by treating psychological distance as a stable, fixed factor, she maintains that examining its effects remains highly valuable within the context of climate change. Reducing psychological distance is proposed as a strategy to promote perceptions of climate change as a threat (Loy and Spence 2020).

News media shape the understanding and knowledge of climate change (Newman et al. 2021; Schäfer and Painter 2021). Within the field of journalism, locality framing is often considered a strategic approach for reporting on climate change issues (Wang and Downey 2025). Personal experience plays an important role in recognizing climate change as a threat to humanity. Since climate change impacts vary by region, local media can serve as key providers of indirect experiences for audiences in less affected areas (Akerlof et al. 2013; Leiserowitz 2006).

Scannell and Gifford (2013) as well as Degeling and Koolen (2022) highlight locality framing as a powerful strategy to foster climate change understanding and pro-environmental behavior. Framing the global phenomenon of climate change in a local way is expected to raise issue salience (Howarth 2017; Howarth and Anderson 2019) as local places are part of people's identity (Proshansky, Fabian, and Kaminoff 1983). In addition, local journalism fosters dialogue and contributes to the creation of a common knowledge base (Devine-Wright 2013; Lester and Cottle 2009; Scannell and Gifford 2013). Leiserowitz et al. (Leiserowitz et al. 2021) propose to include weathercasters as trusted local experts to underline the immediacy of climate change. Sjölander (2021) explored the role of local journalists covering climate change in Sweden. Climate change was a topic widely covered by local journalism. Interviews revealed that local journalists want to serve

democracy by providing necessary information for their audience to form opinions but also monitor politics as "watchdogs". Feygina et al. (2020) showed in an online experiment that watching local climate reports on TV had a positive effect on climate change understanding and on judgments of local and personal relevance. From a science communications perspective, Loy and Spence (2020) conclude reporting local consequences of climate change can reduce psychological distance and thereby increase relevance and climate protective behavior. Further research rooted in environmental psychology and environmental communication stresses local frames and proximity raise issue salience (Howarth and Anderson 2019). Degeling and Koolen (2022) tested the impact of a local and a global infographic about rising sea levels and observed positive effects of the locally framed graphic on attitudinal change.

Consequently, we expect locality framing to have a positive effect on audience perceptions in the context of climate change as framing issues in a local manner is a key characteristic of local journalism. While research in environmental psychology and communication frequently investigates pro-environmental behavior as an outcome (Loy and Spence 2020; Scannell and Gifford 2013), our study centers on risk perception. Risk perception is a common focus in climate change communication research (Yang et al. 2015). We believe it is a suitable measure for the purpose of our study because journalists aim to inform their audience rather than promoting pro-environmental behavior (Loosen, Reimer, and Hölig 2020). Research on risk perception not only supports positive effects of proximity, risk perception also seems to at least moderate the relationship between stimulus reception and pro-environmental behavior (Yang et al. 2015; Zeng, Jiang, and Yuan 2020). Therefore, we investigate risk perception to understand how users interpret a climate change issue in an article, expecting that framing it locally will positively influence this perception.

H1a: Readers are more likely to perceive the risk of heavy rainfall as higher when reading a locally framed article compared to reading a nationally framed article.

News articles on climate change issues usually include attribution frames (Liang et al. 2014). The attribution of responsibility is crucial to understanding political and social issues (Goldberg, Brosius, and De Vreese 2022) and necessary to hold politicians accountable (Rudolph 2006). We expect locality framing to influence readers' attribution of treatment responsibility, which by definition "focuses on the alleviation of the issue" (Iyengar 1989, 878). Proximizing climate change by locality framing presents the issue as less abstract (Buchanan 2009; Loy and Spence 2020) and thereby evokes the perception of the issue as a local problem (Akerlof et al. 2013). A climate change issue happening next door clarifies the need for local action (Leiserowitz 2006). Consequently, responsibility is more likely attributed to the local level. Local actors are the ones to find and implement local solutions (Leiserowitz 2006). Readers of a locally framed article hold in particular political actors on the local level and actors in local communities responsible to find solutions that counter the climate change issue presented.

H1b: Readers are more likely to attribute treatment responsibility to politics on a more local level when reading a locally framed article compared to reading a nationally framed article.

Climate change is perceived as a rather abstract phenomenon with a high psychological distance due to a lack of direct personal experience (McDonald, Chai, and Newell 2015).

Psychological distance influences information processing (Trope and Liberman 2010). If climate change is perceived as psychologically close, mental representations are concrete rather than abstract (McDonald, Chai, and Newell 2015; Trope and Liberman 2010). Information processed this way is easier to assess and more likely to be remembered (Koriat et al. 2004). Communication strategies reducing the psychological distance of climate change are expected to increase knowledge (Monroe et al. 2019). For example, watching localized climate reports enhances climate change understanding (Feygina et al. 2020). By employing locality framing, local journalism situates climate change in a local context as it reports on the appearance of climate change issues and their consequences next door, thereby creating a vicarious experience with a reduced psychological distance. Donnelly (2005) found local reporting increased information recall significantly. We expect locality framing to bridge the psychological distance of climate change and assume a positive impact on memory of the information presented.

H1c: Readers are more likely to memorize article content better when reading a locally framed article compared to reading a nationally framed article.

When considering the effects of locality framing in climate change communication, place attachment is discussed as a factor that particularly influences risk perception (Jayakody et al. 2024). Place attachment describes the bond between a person and a place (Scannell and Gifford 2010). Literature in environmental psychology, where place attachment is widely used, describes two dimensions of place attachment most prominently: *place identity* and *place dependance* (Boley et al. 2021). *Place identity* represents the emotional or symbolic attachment derived from personal experiences made with a place. *Place dependance* refers to functional aspects, addressing the degree to which a place serves an individual's need to achieve individual goals (Boley et al. 2021). Both dimensions describe characteristics similar to the elements forming an individual's sense of place (Massey 1994). Place attachment is thereby used to operationalize and measure the "sense of place" – defined as the intensity of the bond between a person and a location (Scannell and Gifford 2010). Similarly, we use place attachment to operationalize the concept of sense of place in this study.

Recent research provides evidence for positive effects of place attachment: By reviewing quantitative studies on place attachment and climate change adaptation, Jayakody et al. (2024) revealed a strong link between place attachment and risk perception. In addition, studies focusing on institutional or political adaptation reported positive effects of place attachment. Focusing on communication strategies to foster climate change engagement, Scannell and Gifford (2013) examined the effects of local versus national message framing and identified place attachment and locality as key predictors of engagement. Devine-Wright, Price, and Leviston (2015) compared global vs. national place attachment effects on climate change attitudes and opinions. They found that participants with a more global place attachment were more likely to perceive climate change as anthropogenic. Altiney (2017) tested place attachment in an experiment manipulating message framing (local versus global). Students with a strong place attachment perceived the risk for their local environment as higher. We expect place attachment to moderate effects of locality framing on risk perception, responsibility attribution and memory. While positive effects of place attachment on risk perception are well established, we expect similar positive effects on responsibility attribution based on the

relationship between place attachment and political adaptation summarized by Jayakody et al. (2024). Regarding memory, we draw on Scannell and Gifford's (2010, 2013) argument that place attachment increases personal relevance and thereby enhances receptivity to local climate change information. However, to our knowledge, no prior research has investigated the impact of place attachment on responsibility attribution or memory. Thus, H2b and H2c are exploratory.

H2a: The more readers feel attached to their place, the stronger the effect of a locally framed article on risk perception compared to a nationally framed article.

H2b: The more readers feel attached to their place, the stronger the effect of a locally framed article on treatment responsibility attribution compared to a nationally framed article.

H2c: The more readers feel attached to their place, the stronger the effect of a locally framed article on memory of article content compared to a nationally framed article.

Everyday Data Journalism: Interactive Maps

While climate change reporting frequently employs data-driven storytelling with appealing data visualizations, the increasingly limited resources in local journalism pose a challenge to reporting on climate change adequately. Previous studies show that in visualizations, local media have missed opportunities to concretize, situate, or territorialize climate-change phenomena (Gruber et al. 2025). One way to localize visuals can be infographics, for example interactive maps. These practices can be classified as everyday data journalism (Loosen, Reimer, and Hölig 2020) as opposed to news rooms with specialized data teams. Data stories can have different levels of interactivity based on the complexity of choices offered. For this study, we understand interactivity as an interplay between a human user and technology following Steuer (1992): "Interactivity is defined as the extent to which users can participate in modifying the form and content of a mediated environment in real time". Since the early days of online journalism, interactive features offer choices that enable users to create their own experience in the reception process. These choices have changed over time due to increasing possibilities in the digital era: From simply containing hyperlinks (Kenney, Gorelik, and Mwangi 2000) to features such as clicking, sliding, dragging, flipping, hovering, and zooming (Sundar et al. 2014) to interactions with AI-driven chatbots, which can each generate different effects on users. In local journalism, rather simple features are common: Tools available within content management systems or free add-ons such as "Datawrapper" provide an interface requiring no coding-skills to illustrate data interactively and thereby also enable journalists outside of specialized data teams to enrich their stories with data. Local journalists have made data journalism part of their practices (Arias-Robles and López López 2021) and for German data journalists working at newspapers the most important topic is local or regional coverage (Beiler, Irmer, and Breda 2020). For our study, we use an interactive map visualizing the distribution of heavy rainfall events, because a data map is a suitable example of everyday interactivity that can be used within climate change reporting.

The current state of research suggests an impact of offered interactivity on users (Sterman 2011; Ward, Grinstein, and Keim 2015). There are different theories on how

interactivity leads to its effects: one is that the human visual system is sensitive to movements (Franconeri and Simons 2003), so that interactivity increases effects. Another is that the opportunity they facilitate to behaviorally engage with information might play a role, but also that their design and aesthetic appeal simply serve as a heuristic cue (Greussing and Boomgaarden 2021). In most cases this impact is expected to be positive (for an exception see Greussing and Boomgaarden (2021)) with interactive features increasing for example attention and information processing: Greussing, Kessler, and Boomgaarden (2020) found in their study on science news combining eye-tracking and an online survey that interactive features do not immediately grab all attention, but they can lead to more time spent on an article which translates into better learning. In another study, interactivity led to greater cognitive absorption, which contributed to more favorable attitudes toward the messages, but reduced the amount of message-related thoughts (Oh and Sundar 2015). Jia and Sundar (2024) found that interactive data visualization is effective in motivating systematic processing of information, which positively influenced the accuracy of issue perception and personal attitudes to the controversial issues of climate change in their study. With regard to these studies, we expect a positive effect of interactivity on memory.

H3: Readers memorize article content better when reading an article with an interactive map compared to reading an article with a static map.

In addition to memory and knowledge gain, prior research also looked into the effects of interactivity on enjoyment. A meta study by Yang and Shen (2018) comparing 63 studies found that web interactivity was significantly correlated with user enjoyment. Zhang, Zhang, and Pan (2023) analyzed interactivity in data journalism and found that enjoyment mediated the relationship between perceived interactivity and users' attitudes toward the news. Thus, for our study we expect interactivity to have an impact on article enjoyment.

H4: Readers enjoy article content more when reading an article with an interactive map compared to reading an article with a static map.

Based on the current state of research on interactivity, we will test two hypotheses, that we both expect to influence users positively (H3: higher memory, H4: more enjoyment). Thus, we assume a net positive effect of the interaction of these factors. However, no prior studies have explicitly examined the effects of locality framing and interactivity in combination and with regard to our dependent variables risk perception, responsibility attribution and memory. Thus, H5a, H5b and H5c are exploratory.

H5a: Readers are more likely to perceive the risk of heavy rainfall as higher, when reading a locally framed article with an interactive map compared to reading articles nationally framed and/or with a static map.

H5b: Readers are more likely to attribute treatment responsibility to politics on a more local level when reading a locally framed article with an interactive map compared to reading articles nationally framed and/or with a static map.

H5c: Readers are more likely to memorize article content better when reading a locally framed article with an interactive map compared to reading articles nationally framed and/or with a static map.

Method

Study Design and Case Selection

To address the research question and test the hypotheses, we employed a 2 × 2 between-subjects experimental design (article frame: local versus national; map type: interactive versus static) in an online experiment. We preregistered the study design and objectives under the registration identifier AsPredicted#192900. Supplementary study material including the stimulus and the item list can be found online: https://osf.io/u5w2d/overview?view_only=d44bd5282ac44a22b514736d8a637a24. The survey was conducted in a specific region of Germany to emphasize the local focus of the article and target a relevant audience. The region selected for this study was Mittelhessen, located in the central part of Germany, home to around one million residents. The choice of Mittelhessen was informed by several research-related considerations:

(1) Low incidence of extreme weather events: Recent years have seen relatively few extreme weather events in Mittelhessen, which minimizes the influence of participants' personal experiences with such events on their risk perceptions. Prior research (e.g., Akerlof et al. 2013; Scannell and Gifford 2013) indicates that direct personal experiences with the consequences of climate change, such as extreme weather or flooding, can significantly shape individuals' perceptions of these phenomena. (2) Geographical characteristics: Mittelhessen's location in central Germany makes it less vulnerable to flooding compared to other areas as the region is distant from coastal areas and mountain ranges. (3) Local media landscape: The region still has sufficient coverage of local information, particularly through local newspapers, so we assume, with regard to validity, that the local population is familiar with local reporting and has access to it. And finally, (4) practical considerations: The region has a sufficient population density, ensuring the collection of a workable sample size that could be generalized to a limited, geographically defined area.

Participants and Procedure

Participants were recruited through a commercial online access panel in Germany in October 2024. Apart from screening by postal code, no additional criteria or quotas were set. Based on a power analysis for four group fixed effects, main effects and interaction ANCOVA with an effect size of Cohen's f = 0.2 (below medium effect size), we require a sample of around 600 participants (150/cell).

A total of 662 participants completed the questionnaire. During the data cleaning process, 25 participants were excluded for providing a postal code outside the target region. Additionally, five participants were removed as speeders, based on the pre-registration criteria. This resulted in a final sample of N = 632 cases with women being slightly overrepresented (57% women) and young people being slightly underrepresented (51.21 years, SD = 14.47, ranging from 17 to 84 years).

In the online questionnaire, participants were first asked to answer some general questions about their use of local media, their perceptions of a list of societal problems, as well as their general attitudes about climate change. Then, participants were randomly assigned to one of the four stimulus versions. We set a limit of 60 s time spend on the stimulus before participants could proceed to the next page in the questionnaire. After

reading the article, participants were asked to indicate their perception of the article (reading experience, quiz questions, risk perception and responsibility attribution) as well as their self-reported interaction with the map included in the article. After collecting sociodemographic information and postal codes, the questionnaire ended with a debriefing.

Materials

To test effects of locality framing, we prepared two versions of an article on risks of and precautions for heavy rainfall. The article was structured and written by a trained journalist to mimic realistic newspaper reporting, drawing on actual quotes and sources from established German news outlets. One version framed the issue locally and another one set a national frame. Changes between the stimuli included the headline, byline location, photo caption and three sources cited in the article. Additionally, we designed four versions of a geographical map based on data presenting the number of heavy rainfall events in a region. They were built using the tool "Datawrapper", used in several German newsrooms to produce a standard piece of everyday data journalism. Maps embedded in the locally framed article visualized events in the German federal state Hesse, while maps embedded in the nationally framed conditions visualized heavy rainfall events in all federal states of Germany. To account for interactive features in the map, we also manipulated the map's responsiveness. By moving the cursor across the screen, interactive maps revealed the absolute number of heavy rainfall events in the selected area, while in the static map conditions, the absolute number was added as non-responsive text for every area.

The article content, consistent across all four conditions, began with a headline, byline, and teaser. It then progressed through sections detailing areas most affected by heavy rainfall (including a map), a definition of heavy rainfall events, expert estimations on future developments, and advice on self-protection. The article concluded by highlighting and evaluating political actions to counter rainfall consequences. A uniform photo depicting sandbagging was used, with captions varied to fit either a local or national context. The translated material can be accessed via the OSF-Link.

We conducted a pretest with 18 participants prior to the main study and confirmed that the stimulus material was perceived as intended. Participants were asked to assess aspects such as whether the article addressed a national versus local topic and whether it was targeted at a local versus national audience. Additionally, readability items ensured that both article versions offered an equally smooth reading experience.

Measures

Dependent Variables

Risk Perception

Risk perception is assessed according to the method outlined by Walpole and Wilson (2021), using a total of six items that capture two dimensions: Exposure (e.g., "How likely is it that heavy rainfall will occur this year where you live?") and severity (e.g., "If I experienced heavy rainfall, it would have a severe personal impact"). Each item is rated

on a 5-point Likert scale. Separate indices for each dimension were calculated, resulting in an acceptable internal consistency: Risk exposure, three items (α = .694; M = 2.91, SD = .835) and risk severity, three items (α = .677, M = 3.52; SD = .811).

Attribution of Treatment Responsibility

We captured attribution of treatment responsibility using a single-item measure, following the approach of Goldberg, Brosius, and De Vreese (2022) and Arceneaux (2005). We asked participants "'When it comes to protecting your place of residence from the effects of heavy rainfall, who do you believe is particularly responsible for this?" Participants indicated their rating on a 5-point Likert scale for various policy levels, adapted to the German political system (e.g., national, federal state, and local political level). We focus on the local level-item for the analysis (M = 4.34; SD = .881)

Article Memory

To assess participants' memory of article content, we created eight quiz questions based on the content of the article, with varying levels of difficulty. Each question offered three to four answer options, with only one correct answer. For the analysis, we calculated an additive index across all questions. The scale ranges from 0 (no questions answered correctly) to 8 (all questions answered correctly) (M = 5.33, SD = 1.72).

Reading Enjoyment

Enjoyment is assessed following the approach of Zhang, Zhang, and Pan (2023) using three items (e.g., "I found my reading experience pleasant"). Each item is rated on a five-point Likert scale resulting in a satisfactory internal consistency (α = .705; M = 3.31, SD = 0.871).

Moderator

Place Attachment

Place attachment is measured using the shortened version of the place attachment scale by Boley et al. (2021). The scale comprises six items, each rated on a five-point Likert scale. The reliability of the scale was good (α = .931; M = 3.09, SD = 1.09)

Control Variables

Perceived Issue Relevance

As citizens' general interest in topics related to the article was likely to impact a respondent's perceptions of the article, we controlled for its influence. We asked participants to rate the importance of several societal topics on a five-point Likert scale, among them climate change (M = 3.95, SD = 1.15) and heavy rain (M = 3.48, SD = 1.11) as key issues related to the study.

Sociodemographics

We accounted for respondents' age and gender.

Results

Analysis Strategy

We tested our hypotheses with ANCOVAs using responsibility attribution, article memory (H1b, c; H3; H5b, c) and reading enjoyment (H4) as dependent variables. To investigate the effect of our main factors on the two-dimensional risk perception measure (exposure and severity), we calculated a MANCOVA to account for correlation between both measures (H1a, H5a). To test the moderation effect of place attachment (H2), we included an interaction term between locality framing and place attachment in our models, alongside the main effect of place attachment. In each model, locality framing (local vs. national) and interactivity (interactive vs. static map) were included as fixed factors. Participants' age, gender and perceived issue relevance (climate change, heavy rain) were controlled for as covariates. For descriptions of our dependent variables by condition, see Table 1.

Effects of Locality Framing on Dependent Variables (H1)

We did not find significant main effects of the article's framing on our dependent variables. Specifically, there were no significant impacts of local framing on risk perception (exposure; severity) as proposed in H1a, on the attribution of responsibility to local politics (H1b), or on participants' memorizing of article content (H1c). Consequently, we must reject H1a–c (for MANCOVA results, see Table 2, for ANCOVA see Tables 3 and 4). For our participants, the geographical focus of the article – whether it emphasized their own region or Germany as a whole – did not influence their responses to the issue of heavy rain. In our models, the majority of the explained variance was primarily driven by respondents' perceived general importance of the topic, as reflected in the covariates of heavy rain and climate change.

Moderation of Locality Framing and Place Attachment (H2)

To assess whether place attachment moderated the relationship between locality framing and our dependent variables, we created an interaction term (locality framing * place attachment). First, we mean-centered the moderator variable, then calculated the interaction term. We subsequently included both, the main effect of place attachment and the interaction term in the MANCOVA and the ANCOVA models (see Tables 2–4).

Table 1. Descriptives for Dependent Variables by Condition.

M (*SD*)	Local Framing		National Framing	
	Interactive Map (n = 165)	Static Map (n = 149)	Interactive Map (n = 158)	Static Map (n = 160)
Reading Enjoyment*	3.35 (.79)	3.25 (.90)	3.36 (.91)	3.27 (.87)
Local Resp. Attribution*	4.33 (.86)	4.38 (.82)	4.40 (.92)	4.26 (.90)
Risk Perception Exposure*	3.02 (.80)	2.85 (.79)	2.93 (.84)	2.83 (.88)
Risk Perception Severity*	3.53 (.76)	3.50 (.85)	3.52 (.80)	3.53 (.83)
Article Memory**	5.43 (1.62)	5.10 (1.74)	5.48 (1.72)	5.31 (1.79)

*Measured on a 5-point Likert scale
**Additive index ranging from 0 = no correct answer to 8 = only correct answers

Table 2. Test of Between-Subject Effects MANCOVA Results, DVs Risk Perception Exposure and Risk Perception Severity.

		F	*df*	*p*	*Eta*^{2}
Locality Framing	Risk_Severe	.873	1	.350	.001
	Risk_Expose	.125	1	.724	<.001
Interactivity	Risk_Severe	.457	1	.499	.001
	Risk_Expose	**5.62**	**1**	**.018**	**.009**
Locality*Interactivity	Risk_Severe	.339	1	.561	.001
	Risk_Expose	.604	1	.437	.001
(Intercept)	Risk_Severe	117.20	1	< .001	.159
	Risk_Expose	124.44	1	< .001	.167
Place Attachment	Risk_Severe	2.72	1	.100	.004
	Risk_Expose	.924	1	.337	.001
Interaction Locality**Place Attachment	Risk_Severe	.758	1	.384	.001
	Risk_Expose	.861	1	.354	.001
Age	Risk_Severe	2.80	1	.095	.004
	Risk_Expose	9.320	1	.002	.015
Gender	Risk_Severe	14.715	1	< .001	.023
	Risk_Expose	2.01	1	.156	.003
Issue Relevance_Heavy Rain	Risk_Severe	15.61	1	< .001	.024
	Risk_Expose	6.73	1	.01	.011
Issue Relevance_Climate Change	Risk_Severe	119.71	1	< .001	.161
	Risk_Expose	28.69	1	< .001	.044

Model$_{\text{Risk Perception_Severity}}$ F (9, 623) = 29.26, p < .001, adj. R^2 = .287, Model$_{\text{Risk Perception_Exposure}}$ F (9, 623) = 8.58, p < .001, adj. R^2 = .098

The results, however, do not provide support for our hypotheses. We observed no significant interaction effect between place attachment and locality framing across any of the outcome variables. Furthermore, the main effect of place attachment was not statistically significant in any of the tested models. Consequently, we must reject hypotheses H2a, H2b, and H2c, as place attachment does not appear to influence the effectiveness of locality framing in this context.

Effects of Interactive map on Article Memory and Enjoyment (H3, H4)

Consistent with our other null findings, the interactivity condition revealed a similar, non-significant pattern. We did not find a significant effect for the hypothesized positive relationship between the interactive map and the memorization of article content (H3). Consequently, we must reject H3. The same holds true for the impact of interactive features on users' reading experience (H4): Whether participants viewed an interactive or

Table 3. ANCOVA Results, DV = Article Memory

	F	*df*	*p*	*Eta*^{2}
Locality Framing	0.29	1	.590	<.001
Interactivity	2.90	1	.084	.005
Locality*Interactivity	0.52	1	.502	.001
(Intercept)	118.64	1	<.001	.160
Place Attachment	.197	1	.658	<.001
Interaction Locality**Place Attachment	.258	1	.612	<.001
Age	0.912	1	.340	.001
Gender	0.08	1	.928	<.001
Issue Relevance_Heavy Rain	4.34	1	.038	.007
Issue Relevance_Climate Change	15.69	1	< .001	.025

Model: F (9, 623) = 3.16, p < .001, adj. R^2 = .03

Table 4. ANCOVA Results, DV = Local Responsibility Attribution.

	F	*df*	*p*	*Eta*^{2}
Locality Framing	.093	1	.761	<.001
Interactivity	.392	1	.531	.001
Locality*Interactivity	1.83	1	.176	.003
(Intercept)	260.43	1	< .001	.295
Place Attachment	.600	1	.439	.001
Interaction Locality**Place attachment	.463	1	.497	.001
Age	3.87	1	.049	.006
Gender	.968	1	.325	.002
Issue Relevance_Heavy Rain	1.06	1	.287	.002
Issue Relevance_Climate Change	28.77	1	< .001	.044

Model: F (9, 623) = 6.02, p < .001, adj. R^2 = .067

static map did not affect their enjoyment of the reading experience (Table 5). However, from an exploratory perspective, we observed a significant effect of interactive features on participants' perception of risk exposure (F = 5.64, p = .018; Table 2), an effect not initially anticipated in our hypotheses. Specifically, participants who viewed an interactive map reported higher perceived risk exposure (local framing: M = 3.02, SD = 0.80; national framing: M = 2.93, SD = 0.84) compared to those who viewed a static map (local framing: M = 2.85, SD = 0.79; national framing: M = 2.83, SD = 0.88).

Interaction Effect of Locality Framing and Interactive Features (H5)

Due to the non-significant main effects of locality framing and interactive features, it is not surprising that we did not observe the assumed positive relationship of an interaction between our main factors, locality framing and interactive features, on our DVs, as hypothesized in H5a-c (see Tables 2–4 for interaction term).

Discussion

We investigated the influence of two journalistic practices in local climate change reporting: We focused on (1) locality framing, (2) interactive features and (3) as a moderator, place attachment. Firstly, in our study, *locality framing* of a climate-related issue presented in the article had no significant effects on any of our dependent variables. As such, whether the topic is presented through a local vs. national lens did not impact readers' perception of risks related to the issue of heavy rain, their tendency to attribute more responsibility to local politics, or their memory of article content. Secondly, the *interactive*

Table 5. ANCOVA Results, DV = Enjoyment.

	F	*df*	*p*	*Eta*^{2}
Locality Framing	0.63	1	.802	<.001
Interactivity	2.39	1	.122	.004
Locality**Interactivity	0.61	1	.805	<.001
(Intercept)	124.19	1	< .001	.166
Age	1.22	1	.268	.002
Gender	3.44	1	.064	.005
Issue Relevance_Heavy Rain	1.65	1	.199	.003
Issue Relevance_Climate Change	68.45	1	< .001	.099

Model: F (7, 624) = 14.75, p < .001, adj. R^2 = .132

map did not affect users' memory and enjoyment differently than the static version. We did, however, observe an unexpected significant effect: Interactivity slightly heightened participants' perception of risk exposure. Regarding the proposed moderation role of place attachment (H2a-c), our results, again, did not yield evidence of a significant interaction between locality framing and place attachment for any of our dependent variables. Overall, the non-significant results are surprising, especially with regard to locality framing and place attachment, as the state of research clearly provides evidence for positive effects. We make sense of the results of our study below.

We first want to stress that we still believe local journalism has the power to bridge the psychological distance of global topics such as climate change by reporting through a local lens. However, our results suggest the reporting approach of locality framing—by localizing a topic via place mentions, local references and citations of local experts, as suggested by Buchanan (2009)—is not sufficient. The sense of place concept (Massey 1994) and its integration into the geo-social framework set the focus on affective components places have for people. Potentially, the matter-of-fact nature of a typical local news article makes it difficult to trigger those. Journalism research has tested the effects of different genres and storytelling techniques. The evidence underlines the potential of emotionally appealing genres such as narrative features to resonate with audiences (Van Krieken and Sanders 2021). Maier, Slovic, and Mayorga (2017) conclude that story personification is effective to provoke emotional responses in its readers, while straight news stories and statistics did evoke comparatively weak responses. With regard to climate change, Gruber et al. (2025) show that personalized storytelling emotionally resonates with its users and connects everyday experience to the climate crisis. The emotional effects might translate into higher attention, enhanced memory of article content and information processing depth, leading the path, e.g., toward changes in risk perception. Accordingly, it might make sense to localize emotionally appealing genres whilst focusing on local characteristics that are closely tied to the unique place identities local communities share. Such a reporting approach, however, requires journalists to have close ties to and deep knowledge of the local communities they are serving. The increasing heterogeneity of person-place bonds is additionally challenging, as they might come with differing traditions, local codes or important personalities. Thus, whether a local narrative resonates partly depends on the audience's place identities and the degree to which those place identities are shared. Theoretically, an adaptation of Iyengar's (1990) episodic framing, which describes reporting on public issues in a concrete manner by focusing, e.g., on affected people or groups rather than on experts referencing statistics, could be a good starting point to develop alternative approaches of reporting through a local lens beyond Buchanan's (2009) concept.

With our stimulus article, our aim was to provide a locally framed article that represents a realistic example of local journalism and sticks to techniques frequently used by local journalists in Germany. Therefore, we may conclude that locality framing, as it is done in local journalism practice right now, does not produce measurable effects. For journalism practice, the suggested shift from standard news articles toward narrative articles such as features is challenging. Narrative journalism requires advanced skill sets: It is often regarded as demanding because it combines the factual precision of conventional journalism with the narrative techniques of literary writing (Van Krieken and Sanders 2021). Moreover, the reporting process requires greater investments of time, personnel,

and financial resources (Hess and Waller 2017; Jenkins and Nielsen 2018). Thus, it is not surprising that local news outlets frequently employ other reporting approaches.

With our results on *interactivity*, we could only add to the existing body of research showing mixed results regarding its impact (e.g., Greussing and Boomgaarden 2021; Jia and Sundar 2024; Oh and Sundar 2015). Based on the state of research, we had expected a positive influence of the interactivity of the map on memory and enjoyment of the article, which did not manifest. However, interactivity did slightly heighten participants' perception of risk exposure. The interactive map may have enhanced the ability to memorize the number of rainfall events better, as this information appeared visually more prominent compared to our static map, explaining the unexpected significant effect for just one dimension of the risk perception measure. Our results highlight the difficulty in journalism practice and similarly in journalism research to choose the right features or types of interactivity, which are ever-changing (Sundar et al. 2014). Greussing, Kessler, and Boomgaarden (2020) point to the importance of habituation: Some features of interactivity, especially simpler ones, have become so common on websites that they do not attract the attention of all users anymore. Depending on an individual's habituation, some types of interactivity may grab attention belatedly, or may be overlooked or ignored. Based on our findings, we agree with Greussing, Kessler, and Boomgaarden's (2020) conclusion that adding an interactive element to a news story might not influence the complete reception of an article, but only the parts of the article after the interactive element, because only then the user's attention is increased. For journalists, this indicates difficult decisions regarding the balancing of effort put into the development of the different elements of a news article: Choosing a simple interactive feature, as tested in our study, might be low effort, but also result in small effects on the users. More elaborate interactive features might not be habitualized (yet), but demand much more time for their development, which usually must be chipped away from the overall effort for the news story, so that less time is available for the surrounding elements, which might influence the reception of some user groups more than the interactivity. For journalism research, the dilemma is equally challenging: There are many different types of interactive elements available, which should be investigated for their effects, and in addition, the current state of research suggests that the context in which the interactive element is used also plays an important role for its perception (Greussing, Kessler, and Boomgaarden 2020; Greussing and Boomgaarden 2021). Taken together, our findings underscore the complexity of modeling the effects of interactivity on news users.

Regarding the moderator *place attachment*, we suspect that the non-existing effects of our locality framing stimulus are caused by the non-significant results of locality framing and interactivity. Again, we think this is reasonable because of the affective nature of place attachment that is hardly triggered with a standard news article. Prior research points us toward the same direction: Jayakody et al.'s (2024) meta-analysis summarized that place attachment and risk perception are directly linked. Many studies focusing on water-related climate change issues found effects, even though the direction of effects was mixed (Jayakody et al. 2024). From a methodological perspective, however, we cannot rule out that our instrument sensitivity was not sufficient, and effects indeed exist. We observed ceiling effects in local responsibility attribution, alongside participants' consistently moderate risk assessments regardless of article framing. Overall, further research is needed to make sense of the effects of place attachment. To date, the

concept is emerging and seldomly applied to journalism. Nevertheless, we believe that measuring place attachment whilst researching effects of local journalism is fruitful due to its theoretical closeness to the sense of place concept.

Lastly, we may also reflect on the general design of our study. As we pre-tested our stimulus material, we have little reason to assume the manipulation itself (local vs. national framing) was ineffective. But we may consider that a global vs. local design might have yielded significant effects, similar to what Degeling and Koolen (2022) found. Yet our decision to focus on local versus national framing was intentional. Contrasting a national article framing with a local framing is of higher external validity for local journalism compared to a global vs. local framing. In addition to its external validity, our rather simple interactive map was a deliberate choice to ensure the experimental design of our study works. Specifically, we wanted to ensure the amount of information all article versions provided was as consistent as possible to rule out that potential effects are simply the result of a greater amount of information. Thus, we used a rather simple interactive map, which only displayed the total number of heavy rainfall events in a specific area upon cursor movement.

Taken together, our study highlights the complexity of empirically modeling the effects of digital local journalism. For local journalism practice, our findings suggest that locality framing as currently implemented in local news reporting, combined with simple interactive features, may be less effective than hypothesized. While balancing limited resources, digital local journalism may benefit from exploring narrative storytelling techniques and interactive features that are emotional and engaging to foster the diverse connections of audiences to local communities and places. Especially in the light of the null findings of this study, these results as well as our reasoning need to be backed up with further research.

Online Appendix

Supplementary material of the study is available at the following OSF link: https://osf.io/u5w2d/overview?view_only=d44bd5282ac44a22b514736d8a637a24.

Author contributions

CRediT: **Franciska Nowak:** Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing; **Karin Boczek:** Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing; **Leyla Dogruel:** Conceptualization, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

Funding

No funding was received for this study.

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