Narratives of tomorrow: Harnessing artificial intelligence (AI) loss-framed narratives to encourage tourist support for preservation in tourism

Abstract: Given the potential of future-oriented narratives in encouraging tourists' support for preservation in tourism, this research conceptualized and empirically evaluated two types of loss-framed AI narratives using both text and visuals: deprivation of a positive future and presence of a negative one. Through two rounds of focus group discussions, three experimental studies, and two supplemental studies, our results demonstrate that loss-framed narratives depicting the presence of a negative future are more effective in motivating tourists to support heritage preservation than those illustrating the deprivation of a positive future due to evoking fear. Furthermore, this research indicates the critical moderating role of temporal distance, revealing that loss-framed narratives describing the presence of a negative future intensify fear and enhance tourists' support for preservation in distant future scenarios. However, distant future narratives mitigate these observed effects. Our findings provide valuable implications for designing impactful conservation campaigns to promote sustainability in tourism.

Keywords: AI, heritage tourism, loss aversion, fear, temporal distance

1. Introduction

Environmental problems, such as pollution and habitat destruction, emphasize the urgent need for sustainable management to protect natural and cultural heritage. In response, tourism destinations have increasingly adopted behavioral interventions to foster tourist support for preservation in tourism (Hu et al., 2025; Lin et al., 2022). A common strategy to promote tourists' support for preservation involves the use of persuasive messaging, such as "save the planet" signage displayed at destinations. These messages help make the significance of participating in sustainable initiatives more relatable to tourists (Loureiro et al., 2022).

To increase the effectiveness of sustainability communication, previous studies have widely applied the concept of loss aversion, which is a fundamental principle of prospect theory (Tversky & Kahneman, 1992). According to the idea of loss aversion, individuals perceive losses as more psychologically significant than equivalent gains (Ming et al., 2022). In the context of tourism, sustainability messaging emphasizing the negative consequences of inaction or irresponsible behavior tends to be more convincing than messages highlighting the benefits of sustainable practices (He et al., 2024; Song et al., 2025). More importantly, by incorporating a future-oriented perspective, loss-framed text messages underscore the future impacts of current behaviors, making the potential consequences of those behaviors (i.e., losses) feel more resonant (Fong et al., 2025).

However, previous research has predominantly focused on comparing loss-framed and gain-framed text messages (e.g., Cai et al., 2024; Frías-Jamilena et al., 2022), often neglecting the added significance of integrating visuals. While text-based messages can effectively communicate the potential losses faced by tourism destinations, they may not fully capture the emotional and psychological impact that visuals can evoke. Furthermore, most existing research has concentrated on past- or present-oriented text messages (e.g., He et al., 2023), with limited investigations of the potential impact of future-oriented narratives, including both text and visuals, in fostering tourists' support for preservation in tourism. With the capability of artificial

intelligence (AI) to visualize the future of destinations by highlighting either negative or positive consequences (Dubey et al., 2024; Guan et al., 2025), AI-generated visuals can connect abstract concepts with concrete realities. Accordingly, this study builds on traditional loss-framed messages by investigating their application in narratives, with a specific focus on heritage tourism.

This research is among the first to conceptualize two types of loss-framed narratives: the deprivation of a positive future and the presence of a negative future. Based on expectancy theory (Vroom, 1964) and insights from two rounds of focus group discussions, the deprivation of a positive future is defined by its emphasis on missed opportunities and unrealized potential benefits. Narratives representing this type combine positive visuals with loss-framed text messages (e.g., "Without your action to preserve a heritage site, we will not see the beautiful nature"), in which the fear of losing these benefits motivates individuals to act to preserve the envisioned positive future. Conversely, narratives depicting the presence of a negative future focus on severe adverse outcomes, encouraging individuals to take preventive action. Narratives describing the presence of a negative future combine negative visuals with loss-framed text messages (e.g., "Without your action to preserve a heritage site, we will see the damaged nature"). By highlighting the potential for negative consequences, such narratives are designed to evoke fear, thereby encouraging individuals to take decisive steps to protect the environment.

Based on the conceptualization of loss-framed narratives, we conducted three main and two supplemental experiments to examine the impacts of the two narrative types on tourists' actual support for and intentions to support preservation in heritage tourism. Our findings indicated that narratives depicting the presence of a negative future were more effective in promoting tourists' support for preservation than those illustrating the deprivation of a positive future. By ruling out alternative explanations (i.e., hope, personal responsibility, and moral obligation), we identified fear as a key mediator, with narratives depicting the presence of a negative future perceived as more immediate and unavoidable. In addition, temporal distance was identified as a significant moderator of the observed effects. In distant future scenarios, the effectiveness of negative future narratives decreased because of increased psychological distance. Conversely, in near future scenarios, their concreteness enhanced emotional impact, making them more compelling than the abstract narratives focused on the deprivation of a positive future.

Our findings contribute to the theoretical understanding of prospect theory (Kahneman & Tversky, 1979) by extending its application to loss-framed narratives within the context of heritage tourism and sustainability communication. Additionally, we build upon dual coding theory (Paivio, 1971) by demonstrating how the combination of loss-framed text and AI-generated visuals enhances emotional responses, particularly fear, thereby influencing decision-making processes more effectively. Furthermore, this research addresses a gap in the literature by highlighting the critical role of temporal distance as a key moderator that impacts the efficacy of loss-framed narratives. These insights offer valuable implications for developing tailored communication strategies that fully leverage the persuasive power of AI-generated content.

2. Literature Review

2.1. Message framing from a loss aversion perspective and dual coding theory

According to prospect theory (Kahneman & Tversky, 1979), individuals assign different values to gains and losses. A key component of prospect theory is loss aversion, which suggests that

individuals are more motivated to avoid losses than to achieve equivalent gains. By focusing on potential losses, loss framing has been used to elicit stronger emotional responses and encourage more decisive actions compared with gain framing (Bernard et al., 2024). Previous studies on tourism have largely focused on text-based loss framing to promote support for preservation (Cai et al., 2024; Frías-Jamilena et al., 2022; He et al., 2023). While such messages can effectively communicate the risks of inaction, they may be less effective than visuals in evoking emotional and psychological responses (Chan, 2025).

Because visuals can evoke strong emotional responses and generate vivid mental imagery, narratives that integrate both text and visuals tend to be more relatable and impactful, effectively engaging audiences on a deeper emotional level. According to dual coding theory (Paivio, 1971), human cognition operates through two distinct but interconnected systems: a verbal system for processing linguistic information and a non-verbal (or visual) system for processing visual information. These systems can function independently or in tandem, enhancing both memory retention and learning efficiency (Filieri et al., 2021). When information is conveyed through both verbal and visual channels, it increases the likelihood of recall and comprehension by providing multiple retrieval pathways (Gan et al., 2023).

Dual coding theory provides a valuable framework for understanding how tourists process destination-related information (e.g., Zeng et al., 2020). For example, promotional materials that combine descriptive text with vivid visuals can enhance tourists' perceptions and decision-making more effectively than text alone (Fu et al., 2024; Li et al., 2023). Previous studies have suggested that integrating text-based messages (e.g., "Over 8 million tons of plastic enter our oceans annually, endangering marine life and polluting water sources") with visuals (e.g., an image of a sea turtle entangled in plastic waste) increases emotional responses, making environmental issues feel more urgent and impactful and ultimately encouraging responsible behavior (Gan et al., 2023; Zhu et al., 2024). Likewise, eco-friendly destinations that use visual storytelling, such as sustainability infographics, video campaigns, and virtual reality experiences, can enhance tourists' awareness and motivation to adopt sustainable practices (e.g., Homar et al., 2024; Li et al., 2023). However, most previous studies have focused on present-oriented narratives, often overlooking the potential effects and insights that future-oriented narratives might offer in sustainability communication. By integrating text and visuals, narratives generated by AI can bridge abstract concepts with tangible realities, making the consequences of inaction and irresponsible behavior more immediate and compelling.

2.2. Conceptualization of loss-framed narratives

This study provides a nuanced understanding of loss aversion by examining two types of loss-framed narratives: the deprivation of a positive future and the presence of a negative future. According to expectancy theory, motivation is influenced by two mechanisms: the deprivation of a reward and the presence of a penalty (Cai et al., 2023; Vroom, 1964). The deprivation of a reward occurs when expected positive outcomes fail to materialize, resulting in feelings of missed opportunities or dissatisfaction (Zheng et al., 2022). In such cases, individuals are motivated to alter their behavior to avoid adverse outcomes. Conversely, the presence of a penalty involves anticipating severe negative consequences, compelling individuals to take preventive actions (e.g., Malodia et al., 2024; Sajid et al., 2024). Awareness of potential penalties activates fear, which in turn motivates individuals to take decisive action to avert adverse outcomes.

The deprivation of a positive future reflects the concept of reward deprivation, emphasizing the absence of anticipated benefits. When positive expected outcomes are perceived as missing, individuals may feel motivated to pursue an envisioned positive future (Badaan et al., 2022). This sense of deprivation highlights the absence of benefits and can instill fear, which in turn motivates action to avoid losing potential opportunities (Gaudreau et al., 2022). Narratives illustrating the deprivation of a positive future can pair optimistic visuals with loss-framed text messages. These visuals depict thriving ecosystems and healthy environments, highlighting the potential achievements of proactive measures. Conversely, the accompanying loss-framed text, such as "Without your action to preserve a heritage site, we will not see the beautiful nature," indicates the potential loss of these positive outcomes if no action is taken. When individuals perceive that anticipated benefits, such as the preservation of beautiful natural environments, may not materialize, they may experience fear and become motivated to adopt environmentally friendly behaviors (Mattson et al., 2023). The fear of losing these potential benefits encourages individuals to take action to ensure that the envisioned positive future becomes a reality (Procentese et al., 2021; Robin, 2004). By emphasizing the risk of losing anticipated benefits, these narratives effectively motivate individuals to engage in behaviors that support environmental conservation and sustainability.

The presence of a negative future corresponds to the concept of the presence of penalty, emphasizing the anticipation of adverse outcomes. This anticipation can motivate individuals to take action to prevent negative consequences. Recognizing potential penalties fosters a commitment to risk mitigation and harm prevention, driven by the desire to avoid a future in which expected negative outcomes are realized (Qian et al., 2024; Reyna & Farley, 2006). Narratives depicting the presence of a negative future combine pessimistic visuals with loss-framed text messages. These visuals portray environmental degradation, illustrating the severe consequences of inaction. The accompanying text communicates the penalties and negative outcomes of failing to take preventive measures, including "Without your action to preserve a heritage site, we will see the damaged nature." The fear elicited by anticipating these severe negative consequences acts as a powerful motivator, encouraging individuals to adopt sustainable practices and contribute to environmental preservation efforts (van Valkengoed et al., 2022). By emphasizing the likelihood and severity of negative outcomes, these narratives effectively harness fear to motivate individuals to take decisive action to protect and preserve the environment.

Building on the initial conceptualization of loss-framed narratives, we adopted a qualitative approach to deepen the understanding of the two distinct types: the presence of a negative future and the deprivation of a positive future. This approach involved conducting focus group discussions, which allowed us to collect diverse responses to each narrative type. In particular, by examining participants' perceptions, emotions, and interpretations, we determined subtle nuances in how these narratives affect emotional responses and behaviors related to heritage tourism preservation.

3. Qualitative Study: Focus Group Discussions

3.1. Methods

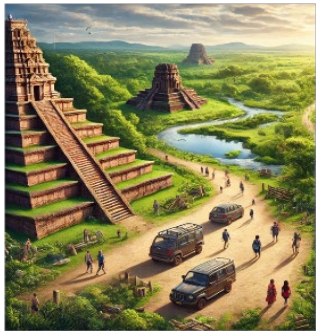
We conducted two rounds of focus group discussions, each featuring two stimuli (i.e., loss-framed narratives; Figure 1). Each session included eight participants, resulting in a total of 16 individuals. Participants were selected using a purposive sampling method to ensure diversity in

terms of gender, age, cultural backgrounds, and education levels, allowing for the collection of nuanced insights into different perceptions and emotional responses. Each discussion lasted approximately 30 minutes, allowing sufficient time for participants to analyze and reflect on their responses to the loss-framed narratives.

During the discussions, participants were encouraged to express their immediate reactions to the loss-framed narratives, focusing on emotional responses, relevance to their personal values, and the perceived impact of these narratives on their willingness to engage in heritage preservation. Open-ended questions guided the discussions, such as "What emotions do these narratives evoke?" and "How do these narratives influence your view of heritage preservation?" Two facilitators ensured that all participants had the opportunity to share their perspectives to minimize potential bias.

To analyze the data, we adopted systematic coding techniques (e.g., thematic analysis) informed by prior studies (e.g., Bambauer-Sachse & Young, 2024; Ling et al., 2025; Soulard et al., 2024). Each discussion was transcribed verbatim, and an iterative coding process was employed to identify recurring themes and emotional responses. The findings provide deeper insights into how participants' emotional responses to loss-framed narratives influence their willingness to engage in heritage preservation efforts, adding reliability and richness to the study's conceptual framework.

Narratives depicting the deprivation of a positive future	Narratives depicting the presence of a negative future
Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision a positive future for this UNESCO site, but warns, "without proper preservation, you will not see this beautiful heritage anymore." [AI-generated visuals used in the first round of focus group discussions]  [AI-generated visuals used in the second round of focus group discussions]	Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision a negative future for this UNESCO site, and warns, "without proper preservation, you will see the environmental degradation and irreversible damage of this heritage." [AI-generated visuals used in the first round of focus group discussions]  [AI-generated visuals used in the second round of focus group discussions]



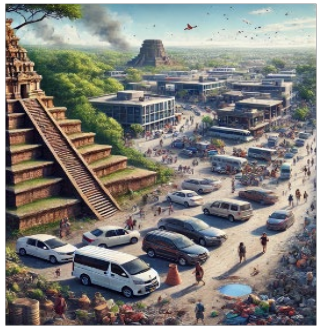


Figure 1. Stimuli Used in Focus Group Discussions.

Note. All visuals were entirely created using ChatGPT-4o.

Source: Authors' Own Work.

3.2. Results

3.2.1. Presence of a negative future

In response to the presence of negative future narratives, the participants reported strong emotional reactions driven by stark visuals and loss-framed messages depicting environmental destruction. Many expressed immediate concerns, describing the visuals as a "*glimpse into a future I want to avoid at all costs*," which prompted them to reassess their daily habits. The irresponsible behaviors identified included excessive waste production, resource overconsumption, and reliance on single-use plastics. These reflections motivated many participants to adopt more environmentally conscious behaviors, such as reducing waste, improving recycling practices, conserving energy, and choosing sustainable products.

The emotional impact was profound, with some of the participants describing feelings of fear and viewing the narrative as a powerful reminder of the consequences of inaction and irresponsible behavior. Fear was identified as a critical component of emotional engagement, making the projected consequences of inaction feel immediate and real. This emotional response acted as a call to action, compelling individuals to make changes for the benefit of both themselves and future generations. One participant noted, "*It was like a wake-up call that I couldn't ignore. I realized I needed to do something now*." Fear evoked by the narrative served to confront the participants with the reality of environmental degradation. Another participant shared, "*Seeing those narratives made me think about the kind of world we're leaving for our children. It's terrifying to think of the damage we're causing*."

Many participants also expressed their commitment to sustainable practices, such as a willingness to "*conserve resources and energy*," "*recycle*," and "*sort garbage*." In addition to personal behavior change, the participants were motivated to raise awareness and educate others about "*the potential future we're heading toward*." Some shared that the narrative sparked meaningful discussions with family and friends, further amplifying its impact. As one participant expressed, "*I talked to my family about what we can do to help, and it feels like we're part of something bigger now*". Another emphasized, "*It's not just about changing my habits. It's about inspiring others to do the same*." These reactions reflect a broader desire to contribute to a cultural shift toward more sustainable practices.

3.2.2. Deprivation of a positive future

In response to the deprivation of positive future narratives, many participants found these narratives profoundly unsettling because they highlighted the severe consequences that could result from inaction and evoked a tangible fear of irrevocable loss. Although the visuals initially presented a positive vision of thriving ecosystems and sustainable communities, the accompanying message emphasized the critical losses that would occur without immediate action. One participant remarked, "*The thought of losing such a beautiful future because of our inaction and irresponsibility is terrifying. It really makes me think about what we can do today*." The contrast between the uplifting visuals and the loss-framed message served as a powerful motivator, indicating both the potential benefits of action and the fear of losing them. Another participant shared, "*The narrative pushed me to reconsider what I could change*."

While the narratives offered a glimpse of what could be achieved, they also highlighted the long and challenging path required to realize such a future. Many participants expressed their willingness to participate in local environmental initiatives or incorporate sustainable practices into their daily lives. One noted, "*I realized I needed to start making changes now, not later*," emphasizing the narrative's immediate impact. Some of the participants voiced their

commitment to sustainable practices, stating their willingness to "*act pro-environmentally*." This reflection inspired a desire for change, motivating the participants to take immediate, actionable steps toward a positive future. Others reinforced this dedication by indicating that they were prepared to "*make an effort to be eco-friendly*," "*engage with local green initiatives*," and "*adopt more sustainable habits in our daily lives*."

3.3. Discussion

The findings of the focus group discussions revealed that loss-framed narratives, both those depicting the presence of a negative future and those illustrating the deprivation of a positive future, effectively elicit emotional responses, particularly fear, which in turn influences participants' efforts to support preservation in heritage tourism. Importantly, none of the participants in the focus group exhibited signs of reactance toward the experimental stimuli, suggesting that the loss-framed narratives were perceived as impactful rather than manipulative or overly coercive. Under psychological reactance theory, coercive messages typically trigger a perceived threat to autonomy, counterarguing, and message derogation (Brehm, 1966; Font & Hindley, 2017). In our sessions, none of these indicators emerged; participants consistently described the narratives as motivating rather than pushy. However, despite these initial insights, empirical evidence remains limited regarding which narrative type is more effective in promoting tourist pro-environmental behavior in tourism. To address this gap, we designed and conducted experimental studies to determine the impact of these two loss-framed narratives on tourists' preservation-related behaviors.

4. Hypothesis Development

4.1. Impact of loss-framed narratives on tourists' support for preservation in tourism

Although both narrative types emphasize future consequences from a loss aversion perspective, we propose that narratives depicting the presence of a negative future are more effective in motivating support than those illustrating the deprivation of a positive future. According to expectancy theory (Cai et al., 2023; Vroom, 1964), individuals evaluate the potential outcomes of their actions based on the likelihood of achieving a desired result and the value they assign to that result. When future outcomes are perceived as certain rather than hypothetical, individuals show a stronger motivation to act, particularly to avoid the definite penalties associated with inaction (Andreoni & Sprenger, 2012). Narratives depicting the presence of a negative future elicit stronger responses when framed as inevitable rather than hypothetical. By combining pessimistic future visuals with loss-framed text messages, these narratives can create a sense of certainty, making environmental threats appear immediate and unavoidable. Conversely, narratives emphasizing the deprivation of a positive future are inherently more speculative. This hypothetical nature can reduce the perceived urgency and certainty of potential consequences.

Based on the concept of negativity bias, narratives depicting the presence of a negative future can effectively inspire tourists to support preservation in heritage tourism (He et al., 2024; Rozin & Royzman, 2001). Negativity bias refers to the psychological tendency to assign greater weight to negative experiences or information than to positive ones (Rozin & Royzman, 2001). Thus, individuals are typically more influenced by negative visuals, which are more likely to be remembered and acted upon than positive visuals (Kim et al., 2021). This inherent bias can significantly affect behaviors and decision-making processes, making narratives that emphasize negative future outcomes, particularly when conveyed through stark imagery, a powerful driver

of behavioral change (Huang et al., 2021). Based on this rationale, we propose the following hypothesis:

H1. Narratives describing the presence of a negative future (vs. the deprivation of a positive future) are more effective in encouraging tourist support for preservation.

4.2. Mediating role of fear

Fear, a negative emotion characterized by increased emotional and psychological arousal, typically arises in response to perceived threats or danger (Engel et al., 2021). Fear motivates individuals to adjust their behavior to avoid undesirable outcomes (Su et al., 2025). Fear-inducing messages have been effectively used in various contexts, including responsible alcohol consumption (Chen, 2016) and health-protective behaviors (Richmond et al., 2023). These messages, often incorporating compelling visuals and text, are designed to evoke increased concern and fear, thereby encouraging responsible actions that reduce perceived risks and prevent negative consequences (Li et al., 2024). In this way, fear can drive individuals to reshape their behaviors, particularly when specific actions are associated with harmful or risky outcomes.

However, the use of fear as a persuasive tool raises an important ethical consideration: the fine line between persuasion and manipulation (Chen, 2016). While fear can be effective in prompting immediate action, they can also evoke strong emotional reactions that may impair individuals' ability to make fully informed and rational decisions (Steg et al., 2014). For example, overly fear-based communication may unintentionally alienate or overwhelm individuals, leading to emotional paralysis or resistance instead of proactive behavior. To address this concern, previous studies suggest that fear-inducing messages should be carefully balanced, providing individuals with information and actionable solutions to empower them, rather than creating a sense of helplessness or exploiting their vulnerabilities (Wheaton et al., 2016; Sharma & Palazzo, 2025).

As suggested in H1, although both narrative types highlight future consequences, the presence of a negative future is generally more effective in encouraging tourists' support for preservation than the deprivation of a positive future. This difference arises from the degree of certainty associated with the outcomes each narrative portrays. Narratives depicting a negative future tend to present consequences as more tangible and definitive, making the potential threats feel immediate and unavoidable (Andreoni & Sprenger, 2012). Thus, these narratives effectively evoke fear, which in turn increases the perceived urgency and emotional intensity of the message. This strong emotional response can motivate individuals to adopt more sustainable behaviors because the threats portrayed in presence of a negative future narratives feel more immediate and inevitable than the less urgent and more hypothetical nature of narratives emphasizing the deprivation of a positive future. Accordingly, fear, as a critical emotional response to future environmental threats, is expected to play a pivotal role in affecting how tourists react to loss-framed narratives in heritage tourism. By contrast, anxiety does not always result from a specific, identifiable stimulus (Barlow, 2002). Even when there is no clear danger, anxiety can arise and persist a while (Barlow, 2002). Note that this study captures emotional responses to the AI-generated future narratives. Thus, fear (vs. anxiety) is more relevant because this study involves a specific, identifiable stimulus (i.e., AI-generated future narratives). We thus propose the following hypothesis.

H2. Fear mediates the impact of loss-framed narratives on tourists' support for preservation.

4.3. The moderating role of temporal distance

Considering that psychological certainty toward loss-framed narratives varies, with the deprivation of a positive future being more abstract and the presence of a negative future more concrete, temporal distance may significantly impact their effectiveness. Research on sustainable behavior emphasizes the significance of aligning message framing with temporal focus to enhance behavioral outcomes (Lee et al., 2024; Song et al., 2025). Temporal distance provides both theoretical and practical insights into how individuals interpret loss-framed narratives. Different temporal distances greatly influence how people mentally process these narratives: near future scenarios promote concrete reasoning and focus on specific details, whereas distant future scenarios encourage abstract thinking and a broader, more generalized perspective (Trope & Liberman, 2010).

In distant future scenarios, we expect that the tangible and definitive nature of the presence of a negative future is likely to be reduced due to the increased psychological distance. As the time horizon extends, the immediacy and concreteness that characterize these narratives may diminish, leading individuals to perceive the potential consequences as less urgent and pressing (Williams et al., 2014). This shift could decrease these narratives' emotional impact and motivational power as the certainty and emotional immediacy that drives action are lessened (Rim et al., 2013). Consequently, the effectiveness of the presence of a negative future in promoting tourists' support for preservation may be compromised in distant future contexts as the perceived threat becomes more abstract and less immediate in the minds of the audience. Therefore, we propose that there are no significant differences between the deprivation of a positive future and the presence of a negative future in terms of fear and tourists' support for preservation in tourism.

However, in near future scenarios, we posit that the concrete and certain nature of the presence of negative future narratives is likely to be further enhanced due to the decreased psychological distance. As a result, the emotional impact and motivational power of the presence of negative future narratives are likely to be amplified, driving individuals to take prompt action to prevent the depicted negative outcomes (Bendell et al., 2020). This heightened perception of immediacy and certainty can significantly boost the effectiveness of these narratives in promoting tourists' support for preservation, as the audience perceives the threats as immediate and unavoidable. However, because of the abstract and uncertain nature of the deprivation of positive narratives, they are not likely to be perceived as immediate and tangible, even in near future contexts (Massara & Severino, 2013). Consequently, we suggest that the presence of a negative future may be particularly effective in evoking fear and motivating sustainable actions in near future scenarios. Based on this, we propose the following hypothesis:

H3. In the distant future scenarios, the effectiveness of narratives depicting the presence of a negative future is likely to diminish. However, in the near future scenarios, the effectiveness of narrative illustrating the presence of a negative future (vs. deprivation of a positive future) remains strong, making them more likely to evoke fear and thereby promote tourists' support for preservation in tourism.

5. Empirical Overview

To test the hypotheses, we conducted three main and two supplemental experiments. Recognizing the importance of loss-framed narratives in eliciting fear and influencing tourists'

intentions to support preservation in heritage tourism, Study 1 focused on two types of loss-framed narratives (deprivation of a positive future vs. presence of a negative future), examining their impact on actual tourist support for preservation, with fear serving as a mediating factor. Study 2 further ruled out alternative explanations (i.e., hope, personal responsibility, and moral obligation). Those three mediators have been widely examined in pro-environmental behaviors (e.g., Fazal-e-Hasan et al., 2024; Hu et al., 2025; Wu et al., 2021). Study 3 examined the moderating role of temporal distance (near future vs. distant future) in the relationship between loss-framed narratives and both tourists' general and specific support for preservation in heritage tourism. Finally, we further conducted two supplemental studies to demonstrate the effectiveness of loss-framed narratives compared to loss-framed text messages. Figure 2 outlines the research framework.

To develop visual components for the two types of loss-framed narratives, we utilized AI, which is a powerful tool for illustrating the future effects on tourism destinations. Specifically, advanced AI platforms, such as ChatGPT and DeepSeek, can transform simple prompts into immersive visuals (Kim et al., 2025; Chu & Liu, 2024). Accordingly, the negative or positive consequences of tourists' behavior on destinations can be vividly and realistically portrayed by AI. For example, AI-generated visuals can simulate the future impacts of climate change on tourism destinations, illustrating how they might be affected by rising sea levels or other environmental threats (McCarthy, 2024; Valença et al., 2025). While there are different formats of AI-generated visuals, such as static images, dynamic videos, and interactive content, we focused on static images. This is to maintain clarity and consistency in our methodology while assessing the overall effectiveness of AI-generated visuals in affecting perceptions and influencing behavior. By focusing on static images, we were able to isolate and analyze their specific impact as a representative format without introducing additional variables that might arise from the complexity of dynamic or interactive content.

In this way, loss-framed narratives, through both text and AI-generated visuals, depict future scenarios in a visually compelling manner, fostering deeper personal and emotional engagement among audiences.

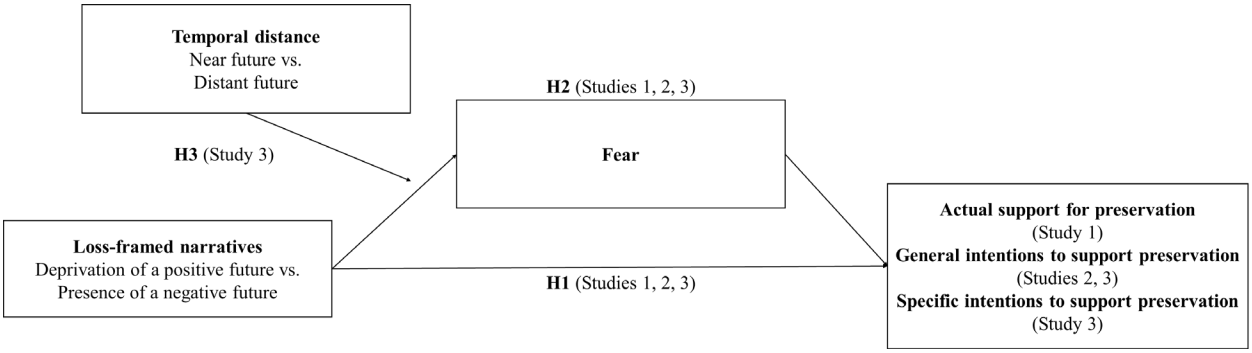


Figure 2. Research Framework
Source: Authors' Own Work.

6. Study 1

To evaluate the effectiveness of loss-framed narratives in eliciting fear and enhancing tourists' support for preservation, Study 1 focused on the impact of two types of loss-framed narratives, namely the deprivation of a positive future and the presence of a negative future, on tourists' actual support for preservation in heritage tourism, with fear serving as a mediating variable.

6.1. Method

We employed a single-factor (loss-framed narratives: deprivation of a positive future vs. presence of a negative future) between-subjects design. A total of 241 participants (M_{age} = 30 years; 53.5% women) were recruited through the Prolific online panel. An a-priori power analysis conducted using G*Power software (Faul et al., 2009) indicated that a minimum of 126 participants was needed to achieve a medium effect size (Cohen's f =.25) with 80% statistical power for a one-way analysis of variance (ANOVA). Accordingly, this experiment was designed to include a sufficient sample size.

The participants were first asked to read the following scenario (Web Appendix B for details): "Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post." The participants were then randomly assigned to one of the two conditions: deprivation of a positive future or presence of a negative future. All participants were informed that they could make donations on site, with contributions going to the UNESCO World Heritage Centre to support site preservation efforts, such as the installation of water filtration systems for wildlife (Web Appendix A for details). The scenarios were developed based on actual donation practices of the UNESCO World Heritage Centre. After viewing the stimuli, the participants were asked to indicate the amount they wished to donate in USD within a simulated setting. Their responses were coded as "0" for those who chose to donate and "1" for those who did not. The participants then reported their level of fear (α = .88) and subsequently provided sociodemographic information. All measurement scales are shown in Appendix A.

6.2. Results

6.2.1. Pre-test: Stimuli realism and manipulation check

To determine the effectiveness of the loss-framed narrative manipulation, we conducted a separate study with 125 participants (M_{age} = 28 years; 59.3% women) recruited from the Prolific online panel. The manipulation check items were newly developed based on previous studies (Cai et al., 2023; Sajid et al., 2024; Vroom, 1964; Zheng et al., 2022). One item assessed narratives depicting the deprivation of a positive future (e.g., "the narrative describes the potential loss of optimistic outcomes for the UNESCO site"; rated from 1 = strongly disagree to 7 = strongly agree), whereas another item assessed narratives depicting the presence of a negative future (e.g., "the narrative describes the pessimistic outcomes for the UNESCO site"; rated from 1 = strongly disagree to 7 = strongly agree).

The participants exposed to the negative future condition perceived the loss-framed narrative as highlighting the presence of a negative future ($M_{\text{presence of negative future}}$ = 5.47, SD = .70 vs. $M_{\text{deprivation of positive future}}$ = 2.58, SD = .73, $p < .001$). Conversely, those in the deprivation of a positive future condition reported that the narrative was framed as the deprivation of a positive future ($M_{\text{presence of negative future}}$ = 2.15, SD = .63 vs. $M_{\text{deprivation of positive future}}$ = 5.85, SD = .78, p

< .001). In addition, the participants in both conditions found the scenario to be realistic when compared with the scale midpoint of 4 (M = 5.33, $t(124) = 22.59$, $p < .001$). Thus, the manipulation in Study 1 was successful.

6.2.2. Actual support for preservation in heritage tourism

The chi-square test results revealed a significant difference in actual support for preservation in heritage tourism between the participants exposed to the presence of a negative future narrative and those exposed to the deprivation of a positive future narrative ($\chi2(1) = 10.2$, $p < .01$). In the presence of a negative future condition, 106 (87.6%) out of 121 participants chose to donate, whereas in the deprivation of a positive future condition, only 84 (70.0%) out of 120 participants made a donation. The findings indicate that loss-framed narratives significantly influenced the participants' actual support for preservation, with the presence of a negative future narrative proving more effective. The results are consistent with controlling for socio-demographic variables (i.e., age, gender, education level, and household income). Therefore, H1 was supported.

6.2.3. Fear

ANOV revealed a significant impact of loss-framed narratives on fear ($F(1, 239) = 21.11$, $p < .001$, $\eta^2 = .08$). A significant difference in fear was observed between the presence of a negative future condition (M = 4.99, SD = 1.65) and the deprivation of a positive future condition (M = 3.99, SD = 1.74). These findings suggest that the participants exposed to the presence of a negative future condition experienced a higher level of fear than those exposed to the deprivation of a positive future condition.

6.2.4. Mediation

To test the mediating role of fear, we used PROCESS Model 4 (bias-corrected bootstrap sample = 5,000; Hayes, 2017), with loss-framed narratives as the independent variable, fear as the mediator, and actual support for preservation as the dependent variable. The analysis revealed a significant indirect effect of loss-framed narratives on actual support for preservation through fear ($a \times b = .46$, 95% CI [.22, .79]). These findings provide empirical support for H2, indicating the critical role of emotional responses, specifically fear, in shaping tourists' support for preservation and demonstrating the potential of strategically framed narratives to enhance engagement in preservation efforts.

7. Study 2

Using a different version of loss-framed narratives, Study 2 extended the findings of Study 1 by incorporating measures of general intentions to support preservation and by ruling out alternative explanations, namely hope, personal responsibility, and moral obligation.

7.1. Methods

We used a single-factor (loss-framed narratives: deprivation of a positive future vs. presence of a negative future) between-subjects design. A total of 206 participants (M_{age} = 31 years; 51% women) from Prolific successfully completed the survey ($N_{Negative} = 102$, $N_{Positive} = 104$). Similar to Study 1, an a-priori power analysis demonstrated an adequate sample size with 80% statistical power. The participants were asked to read the scenario (Web Appendix C for details) and then

report their general intentions to support preservation (α = .89) and their level of fear (α = .87). This was followed by a manipulation check, realism check, and sociodemographic questions. In addition, the participants reported their environmental consciousness (α = .93) and social desirability (α = .92), which were included as control variables. In addition, hope (α = .92), personal responsibility (α = .91), and moral obligation (α = .94) were added to rule out alternative explanations. All measurement scales are provided in Appendix A.

7.2. Results

7.2.1. Pre-test: Stimuli realism and manipulation check

Following the same procedure as in Study 2 to assess the effectiveness of the loss-framed narrative manipulation, we conducted a manipulation check with 126 participants (M_{age} = 29 years; 53.6% men) recruited from the Prolific online panel. The participants exposed to the presence of a negative future condition perceived the loss-framed narrative as highlighting negative future outcomes ($M_{presence\ of\ negative\ future}$ = 5.43, SD = 1.26 vs. $M_{deprivation\ of\ positive\ future}$ = 2.74, SD = 1.16, $p < .001$). Conversely, the participants exposed to the deprivation of a positive future condition reported that the narrative highlighted the deprivation of a positive future ($M_{presence\ of\ negative\ future}$ = 2.48, SD = 1.36 vs. $M_{deprivation\ of\ positive\ future}$ = 5.55, SD = 1.26, $p < .001$). In addition, the participants in both conditions found the scenario to be realistic compared with the scale midpoint of 4 (M = 5.20, t (125) = 10.09, $p < .001$). Therefore, the manipulation in Study 2 was deemed successful.

7.2.2. General intentions to support preservation

For the main analysis, we conducted a one-way ANOVA on two key variables. First, the analysis demonstrated a significant effect of loss-framed narratives on tourists' general support for preservation in heritage tourism (F(1, 204) = 11.02, $p < .001$, $\eta^2 = .05$). The participants in the presence of a negative future condition reported significantly higher support for preservation (M = 6.43, SD = .70) than those in the deprivation of a positive future condition (M = 5.82, SD = 1.73). These findings remained robust even after controlling for the participants' environmental consciousness, social desirability, and gender.

7.2.3. Fear

A one-way ANOVA revealed a significant effect of loss-framed narratives on fear (F(1, 204) = 11.02, $p < .001$, $\eta^2 = .06$). The participants exposed to the presence of a negative future condition reported a significantly higher level of fear (M = 5.07, SD = 1.71) than those exposed to the deprivation of a positive future condition (M = 4.14, SD = 1.88). These results remained robust even after controlling for the participants' environmental consciousness, social desirability, and gender.

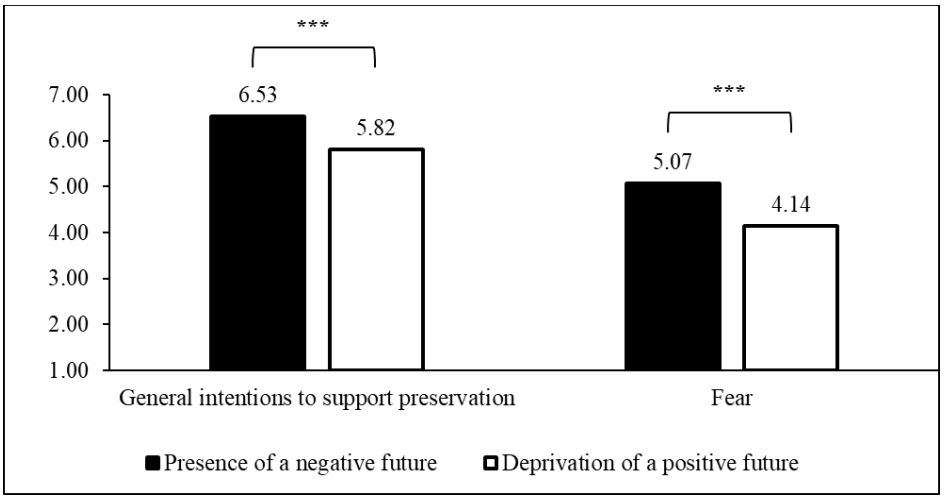


Figure 3. Results of Study 2

Source: Authors' Own Work.

7.2.4. Mediation

We conducted a mediation analysis using PROCESS Model 4 (5,000 bias-corrected bootstrap samples; Hayes, 2017) with general intentions to support preservation as the dependent variable, loss-framed narratives (−1 = deprivation of a positive future, 1 = presence of a negative future), and fear as the mediator. The analysis revealed a significant indirect effect through fear (a × b = .38, 95% CI [.15, .64]), indicating that fear mediated the relationship between loss-framed narratives and general support intentions. Thus, H2 was supported.

7.2.5. Alternative explanations

To rule out alternative explanations, a series of one-way ANOVAs were conducted. The results showed no significant effects of loss-framed narratives on personal responsibility ($M_{\text{presence of negative future}}$ = 3.85, SD = .56 vs. $M_{\text{deprivation of positive future}}$ = 3.86, SD = .55; F(1, 204) = .03, p = .87), moral obligation ($M_{\text{presence of negative}}$ = 5.93, SD = .86 vs. $M_{\text{deprivation of positive future}}$ = 5.91, SD = .97; F(1, 204) = .03, p = .86), and hope ($M_{\text{presence of negative future}}$ = 5.82, SD = .69 vs. $M_{\text{deprivation of positive future}}$ = 5.89, SD = .97; F(1, 204) = .741, p = .40). These results support the validity of our findings by demonstrating that the observed effects were not attributable to differences in hope, personal responsibility, or moral obligation. Instead, they indicated fear as the primary mediator. Together, these findings enhance our understanding of how loss-framed narratives can effectively promote tourists' support for preservation without altering underlying moral or ethical perceptions.

8. Study 3

8.1. Methods

To examine the moderating role of temporal distance, we used a 2 (loss-framed narratives: deprivation of a positive future vs. presence of a negative future) × 3 (temporal distance: near future vs. medium-term future vs. distant future) between-subjects design. A total of 691 participants were recruited from the Prolific online panel. While our primary focus is to compare the near and distant future based on temporal focus, we also incorporated finer-grained temporal

manipulations (i.e., a medium-term future condition) to identify nuanced differences across various time frames. Using G*Power software, an a-priori power analysis revealed that at least 268 participants were needed to achieve a medium effect size for a two-way ANOVA (Cohen's f = .25) with 80% statistical power. Therefore, Study 4 was planned with a sufficient sample size.

The average age of the participants was 31 years, and 52.2% were women. The participants were randomly assigned to one of four conditions that depicted how a natural heritage site might appear (based on either the deprivation of a positive future or the presence of a negative future) in either the near or distant future (Web Appendix D for details). All measurement items were consistent with those used in Studies 1 and 2, with the exception of specific intentions to support preservation (α = .91) and the manipulation check for temporal distance. All measurement scales are presented in Web Appendix A.

8.2. Results

8.2.1. Pre-test: Stimuli realism and manipulation check

We evaluated the effectiveness of the manipulations in a separate study involving 317 participants (M_{age} = 31 years; 58% women) recruited from the Prolific online panel. We followed the same procedure used in Studies 1 and 2 to determine the effectiveness of the loss-framed narrative manipulation. Based on previous studies (e.g., Xu et al., 2023), we conducted a manipulation check for temporal distance using three items: "In the scenario, the narrative is envisioning the distant future of this historic UNESCO site in 10 years," In the scenario, the narrative is envisioning the medium-term future of this historic UNESCO site in 5 years," and "In the scenario, the narrative is envisioning the near future of this historic UNESCO site in 1 year," rated on a 7-point scale (1 = strongly disagree to 7 = strongly agree).

A two-way ANOVA revealed that only the main effect of the loss-framed narrative was significant (F(1, 311) = 341.10, $p < .001$). However, the main effects of temporal distance (F(1, 311) = .15, p = .72) and the interaction effect (F(1, 311) = .20, p = .63) were not significant. Thus, the manipulation of loss-framed narrative was considered successful. Similarly, a two-way ANOVA revealed that only the main effect of temporal distance was significant (F(1, 311) = 172.44, $p < .001$). However, the main effect of the loss-framed narrative (F(1, 311) = .23, p = .60) and the interaction effect (F(1, 311) = .21, $p = .62$) were not significant. Therefore, the manipulation of temporal distance was deemed successful.

8.2.2. General and specific intentions to support preservation

We conducted a two-way ANOVA on general intentions to support preservation. The results revealed a significant main effect of loss-framed narratives ($M_{\text{presence of negative future}}$ = 5.95, SD = 1.24 vs. $M_{\text{deprivation of positive future}}$ = 5.67, SD = 1.64; F(1, 687) = 4.97, $p < .05$, $\eta^2 = .01$) and temporal distance ($M_{\text{near future}}$ = 6.04, SD = 1.41 vs. $M_{\text{medium-term future}}$ = 5.65, SD = 1.07 vs. $M_{\text{distant future}}$ = 5.70, SD = 1.70; F(1, 687) = 4.89, $p < .001$, $\eta^2 = .01$). Moreover, we found a significant interaction effect (F(1, 687) = 4.65, $p < .05$, $\eta^2 = .01$). Additional planned contrast revealed that, in the near future scenarios, narratives emphasizing the presence of a negative future, as opposed to the deprivation of a positive future, were more effective in promoting tourists' general support for preservation in heritage tourism (Mpresence of negative future = 6.39, SD =.69 vs. $M_{\text{deprivation of positive future}}$ = 5.67, SD = 1.65; F(1, 687) = 15.36, $p < .001$, $\eta^2 = .03$). However, in distant future scenarios, the effectiveness of narratives highlighting the presence of a negative future was significantly mitigated (Mpresence of negative future = 5.74, SD = 1.65 vs. $M_{\text{deprivation of positive future}}$ = 5.65, SD = 1.76; F(1, 687) = .27, p = .61). Similarly, in medium-term future scenarios, the

effectiveness of narratives highlighting the presence of a negative future was significantly reduced ($M_{presence\ of\ negative\ future}$ = 5.62, SD = .98 vs. $M_{deprivation\ of\ positive\ future}$ = 5.68, SD = 1.15; F(1, 687) = .09, p = .77).

We conducted another two-way ANOVA on specific intentions to support preservation. Our findings revealed a significant main effect of loss-framed narratives ($M_{presence\ of\ negative\ future}$ = 5.58, SD = 1.30 vs. $M_{deprivation\ of\ positive\ future}$ = 5.30, SD = 1.68; F(1, 687) = 4.49, $p < .05$, $\eta^2 = .02$) and temporal distance ($M_{near\ future}$ = 5.73, SD = 1.47 vs. $M_{medium\text{-}term\ future}$ = 5.23, SD = 1.06 vs. $M_{distant\ future}$ = 5.31, SD = 1.76; F(1, 687) = 7.22, $p < .001$, $\eta^2 = .02$). Furthermore, we observed a significant interaction effect (F(1, 687) =5.52, $p < .01$, $\eta^2 = .02$). Further planned contrast revealed that, in near future scenarios, narratives emphasizing the presence of a negative future, as opposed to the deprivation of a positive future, were more effective in promoting tourists' specific support for preservation in heritage tourism ($M_{presence\ of\ negative\ future}$ = 6.09, SD = .88 vs. $M_{deprivation\ of\ positive\ future}$ = 5.34, SD = 1.82; F(1, 687) = 16.56, $p < .001$, $\eta^2 = .03$). However, in distant future scenarios, the effectiveness of narratives highlighting the presence of a negative future was significantly mitigated ($M_{presence\ of\ negative\ future}$ = 5.35, SD = 1.72 vs. $M_{deprivation\ of\ positive\ future}$ = 5.26, SD = 1.80; F(1, 687) = .219, p = .64). Similarly, in medium-term future scenarios, the effectiveness of narratives highlighting the presence of a negative future was significantly reduced ($M_{presence\ of\ negative\ future}$ = 5.17, SD = .81 vs. $M_{deprivation\ of\ positive\ future}$ = 5.29, SD = 1.27; F(1, 687) = .304, p = .58). The results remained consistent even after controlling for the participants' environmental consciousness, social desirability, and gender. Therefore, H1 was supported.

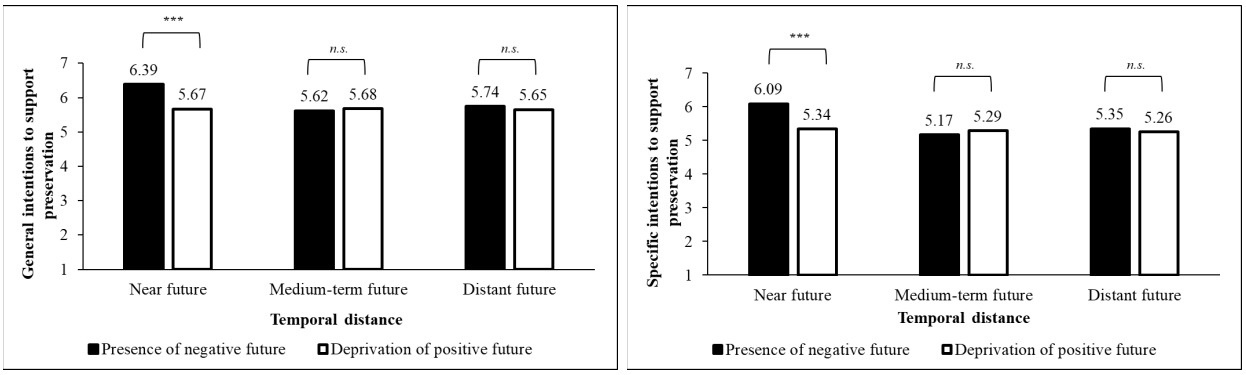


Figure 4. Results of Study 3
Source: Authors' Own Work.

8.2.3. Fear

We conducted a two-way ANOVA on fear. Our results revealed a significant main effect of loss-framed narratives ($M_{presence\ of\ negative\ future}$ =4.86, SD = 1.57 vs. $M_{deprivation\ of\ positive\ future}$ = 4.43, SD = 1.68; F(1, 687) = 10.19, $p < .01$, $\eta^2 = .02$) and temporal distance ($M_{near\ future}$ = 5.24, SD = 1.40 vs. $M_{medium\text{-}term\ future}$ = 4.57, SD = 1.51 vs. $M_{distant\ future}$ = 4.51, SD = 1.76; F(1, 687) = 2.91, $p < .05$, $\eta^2 = .01$). Moreover, we found a significant interaction effect (F(1, 687) = 3.15, $p < .05$, $\eta^2 = .01$). Further planned contrast revealed that, in near future scenarios, narratives emphasizing the presence of a negative future, as opposed to the deprivation of a positive future, were more effective in evoking fear (Mpresence of negative future = 5.24, SD = 1.40 vs. $M_{deprivation\ of\ positive\ future}$ = 4.42, SD = 1.65; F(1, 687) = 16.48, $p < .001$, $\eta^2 = .03$). However, in distant future scenarios, the effectiveness of narratives highlighting the presence of a negative future was

significantly reduced ($M_{presence\ of\ negative\ future}$ = 4.45, SD = 1.75 vs. $M_{deprivation\ of\ positive\ future}$ = 4.40, SD = 1.78; F(1, 687) = 1.07, p = .30). Similarly, in medium-term future scenarios, the effectiveness of narratives highlighting the presence of a negative future was significantly mitigated ($M_{presence\ of\ negative\ future}$ = 4.65, SD = 1.42 vs. $M_{deprivation\ of\ positive\ future}$ = 4.49, SD = 1.58; F(1, 687) = .43, p = .51). The results remained consistent even after controlling for the participants' environmental consciousness, social desirability, and gender.

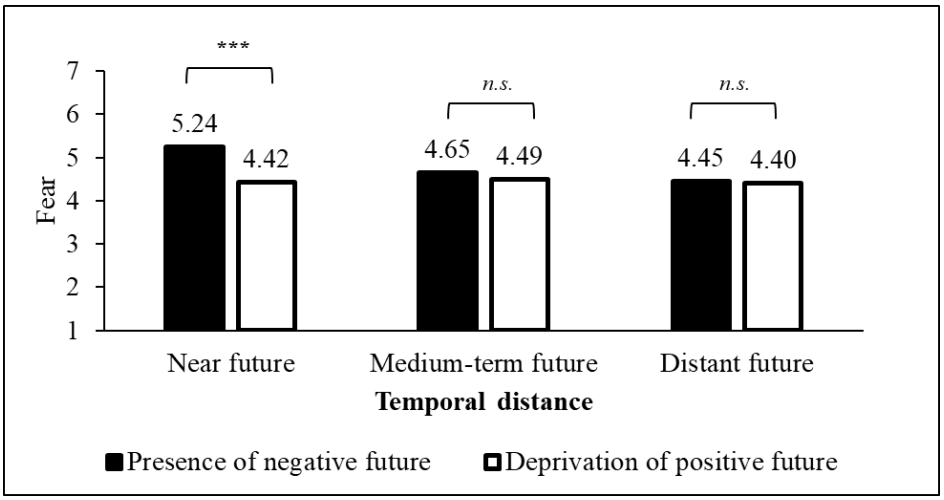


Figure 5. Results of Study 3
Source: Authors' Own Work.

8.2.4. Moderated mediation analysis

Finally, we conducted a moderated mediation analysis using PROCESS Model 8 (5,000 bootstrap samples; Hayes, 2017) with general intentions as the dependent variable, loss-framed narratives (−1 = deprivation of a positive future, 1 = presence of a negative future) as the independent variable, temporal distance (−1 = distant future, 0 = medium-term future, 1 = near future) as the moderator, and fear as the mediator. As anticipated, we observed a significant moderated mediation effect (β = .12, 95% CI [.01, .21]). In near future scenarios, the indirect effect of loss-framed narratives through fear was significant (β = .24, 95% CI [.11, .37]), indicating that narratives highlighting the presence of a negative future, rather than the deprivation of a positive future, were more effective in fostering tourists' general support for preservation in heritage tourism, driven by increased fear. However, in distant future scenarios, the corresponding indirect effect was not significant (β = .04, 95% CI [−.06, .22]) neither (β = .13, 95% CI [−.05, .22]) with medium-term future

Similarly, we conducted a moderated mediation analysis using PROCESS Model 8 (5,000 bootstrap samples; Hayes, 2017) with specific intentions as the dependent variable, loss-framed narratives as the independent variable, temporal distance as the moderator, and fear as the mediator. As anticipated, we observed a significant moderated mediation effect (β = .11, 95% CI [.01, .22]). In near future scenarios, the indirect effect of loss-framed narratives through fear was significant (β = .26, 95% CI [.13, .41]), indicating that narratives highlighting the presence of a negative future, rather than the deprivation of a positive future, were more effective in fostering tourists' general support for preservation in heritage tourism, driven by increased fear. However, in distant future scenarios, the corresponding indirect effect was not significant (β = .07, 95% CI [−.10, .18]), neither (β = .13, 95% CI [−.06, .14]) with medium-term future. The results remained

consistent even after controlling for the participants' environmental consciousness, social desirability, and gender. Therefore, H3 was supported.

8. Discussion and Conclusions

8.1. Discussion

Based on two rounds of focus group discussions, three experimental studies, and two supplemental studies, this research conceptualized two types of loss-framed narratives, namely the deprivation of a positive future and the presence of a negative future, and empirically examined their effects on tourists' intentions to support preservation. While prior studies have primarily focused on comparing loss-framed text messages with gain-framed messages (e.g., Cai et al., 2024; Frías-Jamilena et al., 2022), they have often overlooked the synergistic benefits of incorporating visuals. Given AI's ability to transform simple prompts into immersive visuals, this study advances the understanding of how loss-framed narratives, including both traditional texts and AI-generated visuals, can be framed from a loss aversion perspective. The findings demonstrate that loss-framed narratives, whether emphasizing the deprivation of a positive future or the presence of a negative one, effectively elicited emotional responses, particularly fear, influencing tourists' support for preservation in heritage tourism.

To further evaluate the cultural sensitivity of AI-generated visuals, we conducted a supplementary post-test with 40 MTurk participants from diverse cultural backgrounds (Mage = 28 years; 51% women). We defined culturally appropriate as visuals that demonstrate cultural fit, respect, and non-stereotypical portrayals of people, symbols, and contexts, and relevant as fit to the intended audience and usefulness in conveying the intended message. Participants were randomly assigned to one of the two conditions used in Study 1 and rated the visual on two single-item measures: Cultural appropriateness ("This visual portrays people, symbols, and contexts in a respectful, non-stereotypical manner that feels culturally appropriate for my community.") and relevance ("This visual is a good fit for the stated audience and effectively conveys the intended message."), using 7-point Likert scales (1 = strongly disagree; 7 = strongly agree, adapted and revised from Buzinde et al., 2006; Kastenholz & Gronau, 2022; Kim et al., 2023). Across conditions, participants rated the visuals as culturally appropriate relative to the scale midpoint of 4 ($M = 5.50$, $t(39) = 9.14$, $p < .001$), with no significant differences between conditions ($p = .28$). They likewise rated the visuals as relevant relative to the midpoint ($M = 5.78$, $t(39) = 12.21$, $p < .001$), again with no significant differences between conditions ($p = .31$). These findings suggest that the AI-generated visuals were generally perceived as both culturally appropriate and relevant across conditions.

To enhance the empirical understanding of which type of loss-framed narrative more effectively enhances tourists' support for preservation, we conducted three main and two supplementary experiments. Study 1 revealed significant differences in actual support for preservation, mediated by fear. The participants exposed to narratives depicting the presence of a negative future were significantly more likely to donate than those exposed to narratives focused on the deprivation of a positive future. Study 2 extended these findings by assessing general intentions to support preservation while ruling out alternative explanations, such as hope, personal responsibility, and moral obligation. Study 3 demonstrated a significant interaction effect between loss-framed narratives and temporal distance on fear, with particularly strong effects observed in near future scenarios. Furthermore, our supplemental studies demonstrated that loss-framed narratives were more effective than loss-framed text messages in evoking fear,

which in turn influenced tourists' intentions to support preservation (Web Appendix G for details). These results offer valuable insights into how anticipating future scenarios affects emotional engagement and decision-making.

8.2. Theoretical implications

This research extends the theoretical understanding of loss framing by exploring its application within narratives, particularly in the context of heritage tourism. Traditionally, loss framing has been examined in text-based formats, often in contrast with gain-framed approaches (Hu et al., 2024; Ming et al., 2022). Drawing on the concepts of the deprivation of rewards and the presence of penalties from expectancy theory (Cai et al., 2023; Vroom, 1964), we explore how loss-framed narratives can be constructed to emphasize either the deprivation of a positive future or the presence of a negative future. Our findings establish a foundation for understanding how loss-framed narratives, powered by advanced technologies, can elicit emotional responses, particularly fear, and encourage support for preservation efforts.

The findings of the present study contribute to the theoretical application of dual coding theory (Paivio, 1971) in the context of in heritage tourism. As hiring professional artists to realistically depict future of tourism destinations is costly and takes time, possibly due to the practical reasons, previous studies have mainly focused on text-based message framing strategies to promote pro-environmental behavior among tourists, often emphasizing moral emotions and judgments such as guilt and responsibility (e.g., Hu et al., 2025; Song et al., 2025; Wu et al., 2021). However, the development of AI allows tourism destinations to generate highly realistic visual depictions of tourism destinations, addressing the practical issues. By using both the verbal and non-verbal systems described in dual coding theory, we demonstrate that loss-framed narratives were more effective in evoking fear and influencing tourists' intentions to support preservation in heritage tourism. This dual-channel approach enhances memory retention and learning efficiency, offering a more comprehensive and impactful communication strategy that resonates with audiences on multiple levels (Filieri et al., 2021). Furthermore, by excluding positive emotion, such as hope, we deepen the understanding of negativity bias, highlighting the psychological tendency to prioritize negative emotions, like fear, over positive ones (He et al., 2024; Kim et al., 202; Rozin & Royzman, 2001).

Exploring temporal distance as a moderating factor in the effectiveness of loss-framed narratives provides valuable theoretical insights into how individuals process and react to these narratives. By accounting for the differing levels of psychological certainty associated with each narrative type, where the deprivation of a positive future is generally more abstract and the presence of a negative future is more concrete, our findings align with those of previous studies on sustainable behavior that highlight the importance of aligning message framing with temporal focus to enhance behavioral outcomes (Lee et al., 2024; Song et al., 2025). Temporal distance affects cognitive processing, with near future scenarios promoting concrete reasoning and detailed attention, whereas distant future scenarios encourage abstract thinking and broader perspectives (Trope & Liberman, 2010). This distinction in cognitive processing indicates the importance of strategically framing narratives according to the temporal context to enhance their emotional impact and motivational strength. By understanding how temporal distance influences narrative interpretation, researchers can more accurately predict conditions in which loss-framed narratives would effectively drive pro-environmental actions, offering a nuanced view of the dynamic interaction between narrative framing and temporal perception in affecting behavioral intentions.

8.3. Practical implications

This research offers practical and effective strategies for designing and implementing loss-framed narratives to promote heritage tourism and environmental preservation. By combining AI-generated visuals with loss-framed text-based messages, practitioners can create immersive and emotionally compelling narratives. For instance, an AI-generated visual might illustrate the devastating effects of environmental neglect, such as a cultural site eroded by rising sea levels, accompanied by a message emphasizing the importance of taking immediate action to protect such heritage. These "after" scenarios vividly highlight the potential consequences of inaction, allowing audiences to better comprehend the stakes. By leveraging both cognitive and emotional responses, we can inspire concrete actions, such as contributing to preservation initiatives or actively supporting environmental campaigns.

Practitioners should also consider the role of temporal distance when developing loss-framed narratives. The perceived immediacy of future consequences significantly influences emotional responses and behavioral intentions. Narratives focused on near future threats may generate a stronger sense of fear, prompting immediate action, whereas those highlighting medium-term or distant future outcomes may encourage more reflective responses, potentially reducing the urgency of action. Understanding these dynamics can enable practitioners to tailor their communication strategies effectively, ensuring that the timing of projected outcomes aligns with desired behavioral responses. Organizations can optimize their outreach efforts and achieve more impactful conservation outcomes by strategically integrating temporal distance into loss-framed narratives.

The findings have practical applications beyond tourism campaigns, offering valuable tools for policy-making and education. Policymakers can use loss-framed narratives and AI-generated visuals to raise the awareness about climate change and heritage degradation, fostering public support for conservation initiatives. Educators can leverage these tools to promote environmental responsibility by illustrating the benefits of collective action, such as restoring ecosystems or preserving heritage sites. For under-resourced destinations, cost-effective solutions like open-source AI tools, cloud-based services, simplified templates, and hybrid approaches combining traditional media with basic AI features can be utilized. Partnerships with universities, nonprofits, or tech companies, along with regional networks, can also help share resources and reduce costs. Emerging technologies like virtual and augmented reality can further amplify emotional engagement by offering interactive simulations of preserved and degraded heritage sites, motivating behavioral change and fostering long-term commitments to sustainability and preservation, even in resource-limited contexts.

Finally, to maximize the utility of AI-generated visuals, a balanced loss-framed narrative should present a moderate, credible threat without catastrophizing and pair it with high, specific efficacy through clear, feasible "how-to" actions. It should adopt an autonomy-supportive, noncoercive tone that emphasizes choice and shared stewardship, and use realistic, non-sensational visuals aligned with the text while avoiding dramatic filters, extreme angles, or distracting elements. Together, these practices preserve trust and enhance the message's credibility and effectiveness.

9.4. Limitation and future studies

While this research provides valuable insights into the effectiveness of loss-framed narratives in promoting preservation efforts, several limitations warrant consideration and offer avenues for

future exploration. First, our experiments primarily relied on online panel participants, which may limit the generalizability of the findings to different populations. Future studies should incorporate more diverse demographic groups and cultural backgrounds to gain a deeper understanding of how these narratives affect various groups and ensure the broad applicability of results. Second, although this study primarily focused on tourists' perspectives, it is equally important to consider the opinions and experiences of local residents who are directly affected by preservation efforts. Future research should examine how loss-framed narratives are perceived by local communities and explore how these narratives can foster collaboration between tourists and residents in supporting conservation goals.

Third, our samples were recruited via Prolific, which is efficient for causal identification but may not be fully representative of destination tourists. Prolific participants tend to be more attentive to study materials, more familiar with research tasks, and, on average, may report higher pro-environmental concern than the broader traveling population. These differences, combined with the relatively low-distraction setting of an online study, could magnify the salience and perceived persuasiveness of loss-framed messages relative to in-situ destination contexts where time pressure, competing stimuli, and social cues differ. Future research should replicate these findings in field settings (e.g., A/B testing signage or messaging at attractions) and with samples of current destination visitors, to more precisely estimate effects under real-world attention constraints and social environments. These steps will help delineate the boundary conditions under which loss framing is most effective for tourism sustainability communication.

Fourth, another limitation of this research is that AI-generated visuals were considered as a single category, without differentiating between various formats such as dynamic videos or interactive content. While this approach enabled us to examine the overall effects of loss-framed narratives, including both traditional texts and AI-generated visuals, we acknowledge that different visual formats may elicit fear and emotional responses in unique ways. Future studies should investigate the distinct effects of these formats to gain a deeper understanding of how they influence emotional arousal and behavioral outcomes.

Finally, our findings reflect short-term, intention-level responses measured immediately after exposure and do not verify longer-term donation behavior or sustained engagement. Because fear-based effects often diminish as the sense of threat fades, these results should be read as evidence of immediate mobilization and may represent an upper bound on durable impact. Accordingly, external validity is limited with respect to persistence and real-world enactment. Future research should include longitudinal follow-ups (e.g., 1, 3, and 6 months) with behavioral endpoints, such as incentivized or verified donations, click-throughs to live donation options, and re-engagement metrics, and should test maintenance strategies (e.g., pairing fear with efficacy/hope content, periodic updates, and social norm cues) to assess durability and mitigate decay.

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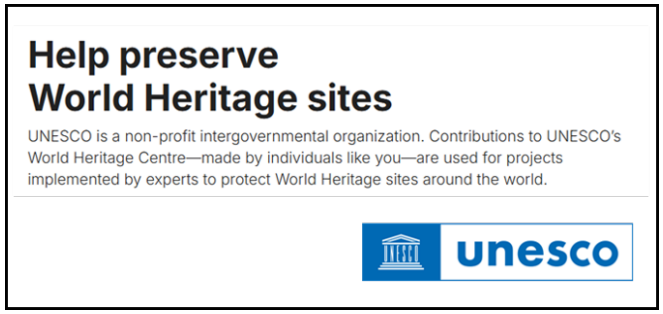
Appendix A. All measurements

Actual donation (Study 1)



- Donations made on-site to the UNESCO World Heritage Centre will support site preservation efforts (e.g., installing water filtration systems for wildlife). How much would you like to donate to the UNESCO World Heritage Centre (in USD; please provide a numerical value)?

Constructs	Items	Reference
General intentions to support preservation (Studies 2, 3, and Supplementary Studies 1a, 1b)	Please select the option that best represents your opinion about the given scenario (1 = Strongly disagree to 7 = Strongly agree; α_{S2} = .89, α_{S3} = .91, $\alpha_{Supplementary1a}$ = .92, $\alpha_{Supplementary1b}$ = .87). • I am willing to behave pro-environmentally during my trip to the historic UNESCO site. • I will behave pro-environmentally during my trip to the historic UNESCO site. I will exert effort to be environmentally friendly during my trip to the historic UNESCO site.	Qin & Hsu (2022)
Specific intentions to support preservation (Study 3)	After looking at the given post, I am willing to _____ at the historic UNESCO site (1 = Strongly disagree to 7 = Strongly agree; α = .91). • Conserve resource and energy • Recycle • Sort garbage • Use "green" (non-plastic) shopping bags (e.g., paper bags)	Wu et al. (2022)
Fear (Studies 1, 2, 3, and Supplementary Studies 1a, 1b)	Given the scenario, to what extent do you feel_____ about the future of the heritage (1 = Not at all to 7 = Very much; α_{S1} = .88, α_{S2} = .87, α_{S3} = .92, $\alpha_{Spplementary1a}$ = .91, $\alpha_{Supplementary1b}$ = .89). • Fearful • Afraid • Scared	Zheng et al. (2022)
Environmental consciousness (Studies 2, 3)	Please select the option that best represents your opinion (1 = Strongly disagree to 7 = Strongly agree; α_{S2} = .93, α_{S3} = .94). • I prefer to buy a product if I believe it was made from recycled materials. • I prefer to buy a product if I believe it was packaged in an environmentally friendly manner. • I prefer to buy a product if I believe it was produced in a climate-friendly manner.	Lin et al. (2012)

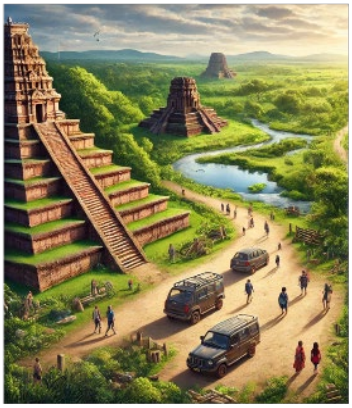
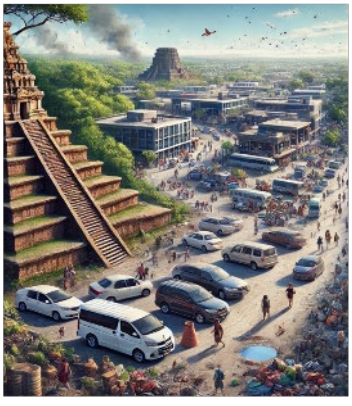
Social Desirability (Studies 2, 3)	Please select the option that best represents your opinion (1 = Strongly disagree to 7 = Strongly agree; α_{S2} = .92, α_{S3} = .95). • Were you ever greedy by helping yourself to more than your share of anything? • Have you ever taken anything (even a pin or button) that belonged to someone else? • Have you ever cheated at a game? • Have you ever taken advantage of someone? • Are all your habits good and desirable ones? • Do you always practice what you preach?	Feldman (2019)
Hope (Study 2)	Given the scenario, to what extent do you feel_____ about the future of the heritage (1 = Strongly disagree to 7 = Strongly agree; α = .92). • Hopeful • Optimistic • Encouraged	Fazal-e-Hasan et al. (2024)
Personal responsibility (Study 2)	Please select the option that best represents your opinion (1 = Strongly disagree to 7 = Strongly agree; α = .91). • Because my personal contribution is very small, I do not feel responsible for the future of the heritage without proper preservation. • I do not feel responsible for the future of the heritage without proper preservation. • I feel responsible for the heritage without proper preservation. • I feel at least co-responsible for the future of the heritage without proper preservation.	Culiberg et al. (2022)
Moral obligation (Study 2)	Please select the option that best represents your opinion (1 = Strongly disagree to 7 = Strongly agree; α = .94). • I feel a moral obligation to protect the historic UNESCO site. • I should protect the historic UNESCO site. • It's important that people in general protect the historic UNESCO site. • Because of my own values, I feel an obligation to behave in an environmentally friendly way.	Wu et al. (2021)

Appendix B. Study 1. Stimuli and scenario

Narratives depicting the deprivation of a positive future	**Narratives depicting the presence of a negative future**
Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision a positive future for this UNESCO site, but warns, "without proper preservation, you will not see this beautiful heritage anymore." 	Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: we envision a negative future for this UNESCO site, and warns, "without proper preservation, you will see the environmental degradation and irreversible damage of this heritage." 

Note. All visuals were entirely created using ChatGPT-4o.

Appendix C. Study 2. Stimuli and scenario

Narratives depicting the deprivation of a positive future	**Narratives depicting the presence of a negative future**
Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision a positive future for this UNESCO site, but warns, "without proper preservation, you will not see this beautiful heritage anymore." 	Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision a negative future for this UNESCO site, and warns, "without proper preservation, you will see the environmental degradation and irreversible damage of this heritage." 

Note. All visuals were entirely created using ChatGPT-4o.

Appendix D. Study 3. Stimuli and scenario

Narratives depicting the deprivation of a positive future (near future)	**Narratives depicting the presence of a negative future (distant future)**
Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision the near future for this UNESCO site in one year, but warns, "without proper preservation, you will not see this beautiful heritage anymore." 	Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision the distant future for this UNESCO site in 10 years, and warns, "without proper preservation, you will see the environmental degradation and irreversible damage of this heritage." 

Note. All visuals were entirely created using ChatGPT-4o.

Appendix E. Supplemental Study 1a. Stimuli and scenario

Text-based messages depicting the deprivation of a positive future	**Narratives depicting the deprivation of a positive future**
Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision a positive future for the UNESCO site, but warns, "without proper preservation, you will not see the beautiful heritage anymore."	Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision a positive future for the UNESCO site, but warns, "without proper preservation, you will not see the beautiful heritage anymore." 

Note. All visuals were entirely created using ChatGPT-4o.

Appendix F. Supplemental Study 1b. Stimuli and scenario

Text-based messages depicting the presence of a negative future	**Narratives depicting the presence of a negative future**
Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envisions a negative future for the UNESCO site, and warns, "without proper preservation, you will see the environmental degradation and irreversible damage of the heritage."	Imagine you are considering a visit to a natural and historic UNESCO site known for its beautiful landscapes and rich cultural heritage. Before your trip, you visit the site's official website to gather more information. There, you come across the following post: We envision a negative future for the UNESCO site, and warns, "without proper preservation, you will see the environmental degradation and irreversible damage of the heritage." 

Note. All visuals were entirely created using ChatGPT-4o.

Appendix G. All measurements

8. Supplemental Studies

Supplemental Studies 1a and 1b were conducted to further evaluate the effectiveness of loss-framed narratives by comparing them with loss-framed text messages that did not include AI-generated visuals.

8.1. Supplemental Study 1a

8.1.1. Method

We used a single-factor (loss-framed narratives$_{\text{deprivation of positive future}}$ vs. loss-framed text messages$_{\text{deprivation of positive future}}$) between-subjects design. A total of 200 participants (M_{age} = 29 years; 61.3% men) were recruited from the Prolific online panel. The participants were randomly assigned to one of two conditions (Appendix E: (1) the narrative depicting the deprivation of a positive future or (2) a text-based message depicting the same deprivation without any visuals. All measurement scales are presented in Appendix A.

8.1.2. Results

The participants who viewed narratives illustrating the deprivation of a positive future perceived the narratives as being accompanied by visuals (M = 5.53, SD = .78) to a significantly greater extent than those who viewed text-based messages without visuals (M = 2.06, SD = .66, $p < .001$). In addition, the participants in both conditions found the scenario to be realistic compared with the scale midpoint of 4 (M = 5.72, t (199) = 27.99, $p < .001$). These results confirm that the manipulation in Supplemental Study 1a was successful.

For the main analysis, we conducted a one-way ANOVA on general intentions to support preservation in heritage tourism. The results revealed a significant effect of loss-framed narratives on tourists' general support for preservation in heritage tourism ($F(1, 198) = 35.41$, $p < .001$, $\eta^2 = .15$). Specifically, the participants exposed to narratives depicting the deprivation of a positive future reported significantly higher support for preservation (M = 5.83, SD = 1.74) than those exposed to text-based messages with the same framing but without visuals (M = 4.43, SD = 1.59).

8.2. Supplemental Study 1b

8.2.1. Method

Supplemental Study 1b used a single-factor (loss-framed narratives$_{\text{presence of negative future}}$ vs. loss-framed text messages$_{\text{presence of negative future}}$) between-subjects design. A total of 204 participants (M_{age} = 28 years; 57.3% women) were recruited from the Prolific online panel. The participants were randomly assigned to one of two conditions (Appendix F). Consistent with the findings of Supplemental Study 1a, the manipulation in Supplemental Study 1b was effective.

8.2.2. Results

We conducted a one-way ANOVA on general intentions to support preservation in heritage tourism. The results revealed a significant effect of loss-framed narratives on tourists' general support for preservation in heritage tourism ($F(1, 202) = 98.68$, $p < .001$, $\eta^2 = .32$). The participants exposed to narratives depicting the presence of a negative future reported

significantly higher support for preservation (M = 6.33, SD = .85) than those exposed to text-based messages with the same framing (M = 4.42, SD = 1.88). In addition, we conducted another one-way ANOVA on fear. The results revealed a significant impact of loss-framed narratives on fear ($F(1, 198) = 36.15$, $p < .001$, $\eta^2 = .15$). Fear was significantly higher among the participants exposed to narratives depicting the presence of a negative future (M = 4.84, SD = 1.65) than among those exposed to text-based messages depicting the presence of a negative future (3.37, SD = 1.83).

Taken together, Supplemental Studies 1a and 1b demonstrated that loss-framed narratives were more effective than loss-framed text messages in evoking fear and enhancing tourists' intentions to support preservation in heritage tourism.