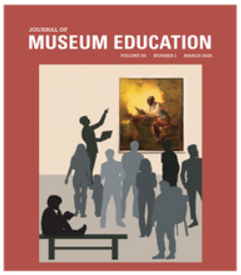

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Exploring Emotional Reactions and Regulation Strategies in Climate Change Contexts: Insights from a Museum Exhibit

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ABSTRACT

Given that climate change is an urgent global threat, understanding how people emotionally respond to it is of critical importance; however, there is limited understanding of how people manage their emotions about climate change. To address this gap, we adopted a climate change museum exhibit as a naturalistic setting to explore how 183 visitors' emotional responses relate to their emotion regulation approaches to climate change. People who adopted more eco-conscious strategies (e.g. moral engagement, planning, environmental efficacy, and connecting with the environment) experienced more intense emotions, implying their value in motivating climate action. Similarly, those who employed hope-based regulation had intense emotional reactions. In contrast, those who employed an apathetic approach to the climate crisis had subdued emotional responses. Overall, this study suggests that emotional responses to climate change and associated eco-conscious dispositions were a helpful approach. Museums are a trusted public institution that promotes an understanding of how people manage their emotional reactions to climate change, which is crucial for both maintaining well-being and fostering openness to climate action, thus advancing sustainability efforts. These findings are also relevant for museum practitioners to be aware of museum visitors' potential negative emotional experiences and to provide resources for climate action.

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Climate change; museum exhibit; emotion; emotion regulation; applied cognition

Climate change is a divisive topic that elicits a wide range of responses among people, which can ultimately inform climate-friendly actions or inaction.[1] While growing literature has started to examine individual differences in emotional responses, there is still limited understanding of how people cope with the reality of climate change, particularly within naturalistic settings such as museums.[2] The current study addressed this knowledge gap by examining how people manage their emotions around climate change issues in a museum exhibit.

The role of emotion and its regulation in the climate change context

When addressing climate change problems, why do emotions matter? Research has shown that experiences of negative emotions may not necessarily be bad and may represent something more behaviorally meaningful. For instance, Ogunbode et al. argue that negative experiences around climate change can facilitate pro-climate behaviors.[3] Furthermore, a systematic review found that negative emotions significantly contribute

to motivating behaviors to climate change adaptation.[4] Thus, negative emotions can play a central role in climate-friendly actions.

This raises the question of how different types of emotion regulation may impact climate change-related emotions. Reser and Swim have argued that two categories of emotion regulation approaches can be identified – reactive versus proactive.[5] *Reactive* forms of regulation, such as apathy, are unhelpful approaches to processing climate change.[6] *Apathy* entails indifference and a lack of concern about the severity of climate change challenges and dismissing or belittling the climate change problem.[7] Apathy involves managing feelings of helplessness, guilt, and fear by distancing oneself from climate change information, thereby avoiding engagement.[8] Both apathy and avoidance approaches play an important moderating role in the relationship between feelings of distress toward climate change and pro-climate behavior.[9] These constructs were targeted in our study. Drawing from emotion regulation literature, reactive ways of management are viewed as unhelpful or maladaptive.[10]

In contrast, *proactive* regulation in the context of climate change entails recognizing the threats posed by climate change and actively working toward mitigating and adaptation. An important component of proactive regulation is *eco-consciousness*, which involves recognizing the causes and consequences of climate change and engaging in solutions to address them.[11] Examples of such meaningful engagement via eco-consciousness include feeling moral responsibility, planning, and making climate-friendly decisions. Importantly, feelings of connection to nature, particularly local and meaningful natural environments like community parks, are associated with more receptiveness to messages of pro-environmental behavior.[12] Along similar lines, there is environmental efficacy, which includes belief in one's ability to do something about climate change.[13] Individuals demonstrating the above approaches have been found to engage proactively in climate action.[14]

Another emotion regulation strategy that fits within proactive ways to cope with the climate change challenges is hope. *Hope* involves an acknowledgment of the realities of climate change, and with this acceptance, there can come a realistic approach to addressing climate challenges individually and as a community.[15] Hope has been considered an adaptive way of dealing with climate change. Another distinct proactive approach is *spirituality*, which involves focusing on religious practices to regulate affective response. Spirituality has been found to be a way to reduce climate distress.[16] Accordingly, we focused on these concepts to capture how people cope with climate change information.

Museums are suitable for examining emotions

Museums are trusted public institutions that provide open and informal spaces for sharing objective information.[17] They are well-situated to engage the public in learning about climate change,[18] and many museums have already created such opportunities.[19] Additionally, museums are informal learning environments that people *choose* to visit in their leisure time, filled with opportunities for learning within close-knit families and social groups.[20] Because of this, museums can offer a prime space to study learning within naturalistic settings.[21] In particular, exhibits about climate change provide a critical space to understand learners' complex emotional responses as they engage with interactives and information.

The current study

Given the open and informal learning environment museums can provide, this study was conducted in a natural history museum to offer evidence-based perspectives about climate change. The museum visitors in this study visited an exhibit on the impacts of and solutions to climate change. To capture how people dealt with climate change, we examined how typical emotionally apathetic versus eco-conscious dispositions specific to climate change were related to the emotional experiences of the museum exhibit.

By examining visitors' emotional responses to an innovative climate exhibit – *Hopeful Future* (HF) – we can begin to parse the relationship between climate learning experiences and emotion, thereby offering insight into the design of museum-based climate education. To examine this, museum visitors interacted with an exhibit, "Hopeful Future," and were asked to report their emotional experiences in response. Emotional ratings were collected immediately after participants saw the climate change impact section of the exhibit. We also assessed apathetic and eco-conscious ways participants typically coped with climate change. To capture these forms of emotion regulation, we utilized and adapted past surveys (as detailed in the methods section). Based on past research,[22] we expected that eco-consciousness would be related to experiences of stronger negative emotions in response to science-based information about climate change presented in the museum exhibit, where as more muted emotional response was expected by those typically employing apathy toward climate change. More broadly, we explored how proactive and reactive emotion regulation efforts are linked to climate emotions.

Method

Participants

183 museum visitors completed the study ($M = 32$ years, SD = 15.16). Based on self-reported gender, 45.3% were females, 46.3% were males, 2.6% were genderqueer, and 2.5% were other. Among participants, 1.5% were American Indian and Alaskan, 9% were Asian, 1.5% were African American, 64.7% were Caucasian, 8% were mixed race, 5% were other Pacific Islander, and 11.5% were other.

Museum exhibit details

This study took place in a medium-sized natural history museum in the US, within a newly installed exhibit – *Hopeful Future* (HF, a pseudonym). HF was developed through a rigorous, iterative process[23] and uses strategic framing[24] to engage visitors in learning about climate change impacts and solutions. Throughout the exhibit, a framing of rational hope[25] is used, intending to support visitors' understanding of the magnitude of the problem as well as the types of solutions that are possible and underway. For the purposes of this study, we focus on two sections, as the sections most likely to provoke strong emotional responses: "Heating up" and "Community-oriented action."

"Heating up" (HU) was the section that presented scientifically accurate (and thus most negative) information about climate change trajectory. This section included images, text panels, and interactive interfaces exhibiting the ways climate change is progressing and the impact it is having on the local community, such as increased temperatures, wildfires, and floods. Instances specific to the local community were the primary

focus to highlight the immediate relevance of climate change. While examining experiences of negative emotions, HU was studied as it had scientifically accurate yet quite unpleasant content about climate change.

In contrast, "Community-oriented action" (COA) was the section that presented the most pleasant future-oriented information (likely to lead to positive emotions). It focused on connecting with others in your community and imagining possibilities for the future, as well as interactive options to address climate change. While examining experiences of positive emotions, the COA section was analyzed because it had the most pleasant science-informed and solution-focused information about climate change.

Measures

Emotional experiences

To assess negative emotion, a series of emotional words were presented to the participants.[26] They were asked, "As you went through the *[name] section*, did you feel any of the following" emotions? The options available to participants were: *Not at all* to *A great deal*. The negative words were Sad, Hopeless, Afraid/Scared, Anxious, Indifferent, Guilty, Numb, Angry/Frustrated, and stressed. The positive words were Optimistic, Hopeful, Inspired, and Happy. An average of all the negative and positive words was calculated to get a composite of negative and positive affect.

Emotion regulation items

Participants were informed that

> Going through the exhibit elicits a variety of thoughts and responses in people and reminds them of their opinions of climate change. The following survey aims to explore how different visitors generally deal with various experiences around climate change. We present several possible ways one may think about or act towards climate change. Take your time to think about the extent to which each statement is true for you in general. Answer the questions in terms of how much or to what extent you typically deal with or respond to experiences around climate change (in general, not just limited to this exhibit).

Table 1 presents the items that were utilized to capture how participants generally manage their responses to climate change issues using a Likert scale (*Not at all – Extremely*). These included several affective factors that were adapted from past work: *eco-consciousness, hope, spiritual practices, and apathy-focused regulation items*.[27]

Procedure

After completing the consent form procedure as approved by the IRB, participants were given an iPad that they could bring with them as they went through the exhibit. We examined the experiences of participants when they visited HU, the most negative portion of the exhibit, which presented a factual account of the current state of climate change issues and how it affects the local community. The negative affective experiences were recorded right after participants had visited this section and linked to their general response to climate change. Next, visitors' positive affective experiences were recorded right after participants visited COA, the most pleasant and hopeful section

Table 1. The items that were utilized to capture how participants typically manage their responses to climate change issues. The affect regulation factors that were Eco-consciousness, Hope, Spiritual practices, and Apathy. Each factor had underlying affect regulation strategies.

Factor	Emotion regulation strategies	Item assessed
Eco-consciousness	Connection with the environment	I thought about how my actions affect the environment
	Moral responsibility to engage	I felt a moral duty to do something about climate change
	Planning to problem-solve	I thought hard about what steps to take
	Eco-conscious cognition	Climate change forced me to change the way I think about how we live and use our natural environment in [state]
	Environmental efficacy	I felt that I can do something about climate change
Hope	Hope in humanity	I have faith in humanity; I believe we together can do something about climate change
	Hope in scientists	I have faith in scientists and people engaged in environmental organizations to come up with a solution in the future
	Hope in solution	I've been thinking the climate change problem will be solved in the future
Spiritual practices	Religious and spiritual practices	I've been trying to find comfort in my religion or spiritual beliefs
Apathy	Indifference	I felt indifferent to what is going on with climate change
	Lacking care	I do not care about climate change
	Underestimation	I thought the climate change threats have been exaggerated
	Belittling	I felt that nothing serious will happen during my lifetime

of the exhibit. The emotional regulation responses were reported after museum visitors had completed the exhibit.

Results

Links between negative experiences and regulation during the most unpleasant section

The most unpleasant portions (HU) were related to higher negative reactivity from those who had more eco-conscious, i.e. environment-friendly dispositions. See Figure 1(a) for the overall pattern, which shows that the more eco-conscious an individual was about climate change, the more negative they felt while going through the (HU) exhibit section, i.e. a strong direct correlation with several eco-consciousness approaches were found as evident by positive coefficients. Specifically, those who felt they were mindful of their *connection with the environment* experienced higher negative emotion, $r(180) = .497$, $p < .001$. Those who reported feeling a *moral responsibility to engage* with climate change action reported higher negative emotion, $r(181) = .457$, $p < .001$. *Planning to problem-solve* the climate change issue was also related to higher negative emotion, $r(180) = .433$, $p < .001$. *Eco-conscious cognitions* were associated with the experience of higher negative emotion in the HU section, $r(180) = .349$, $p < .001$. Finally, having *environmental efficacy* was linked to higher negative emotion experiences in the HU section, $r(181) = .208$, $p = .005$.

In contrast, the negative emotional reactions to the most unpleasant exhibit section (HU) were inversely related to apathy, i.e. the more apathetic a person was about climate change, the less negativity they felt about the HU section of the

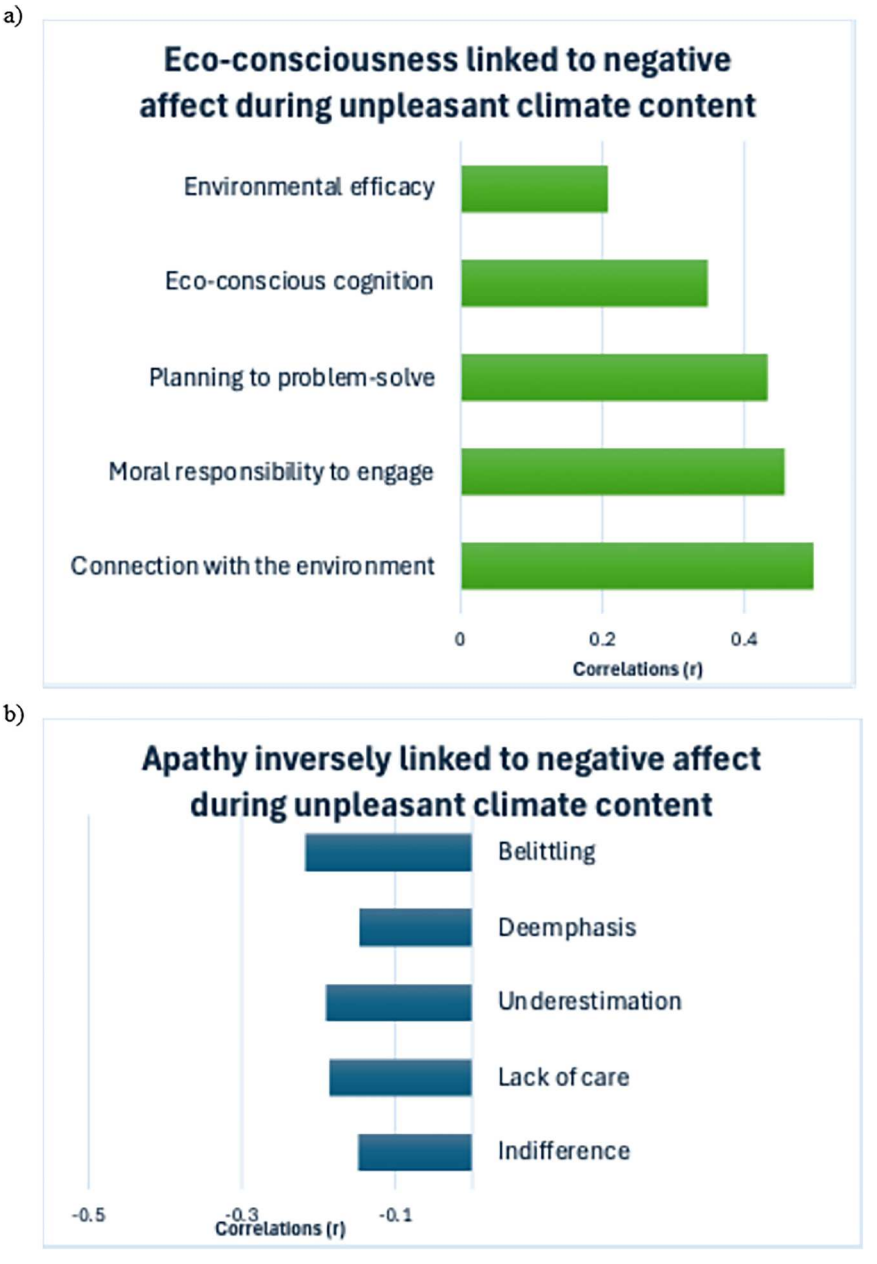

Figure 1. Emotion regulation strategies were linked to the experience of negative emotions during *Heating Up (HU)*, the most unpleasant portion of the museum exhibit. (a) The figure shows the relationship between environmentally friendly (i.e. eco-conscious) approaches and negative affect (shown as separate bars). The more environmentally friendly approaches employed in daily life, the more negative affect participants felt while visiting the (HU) exhibit section (i.e. they moved together due to a positive correlation between eco-consciousness and negative affect). (b) The figure shows the relationship of apathetic approaches to negative affect (shown as separate bars). The more apathetic an individual was about climate change, the less negative affect they felt while visiting the (HU) exhibit section (i.e. they moved in an inverse direction due to a negative correlation between apathy and negative affect).

exhibit. See Figure 1(b) to see the overall pattern for apathy-related dispositions inversely linked to negative responses (i.e. a negative correlation between apathy and negative affect). Specifically, higher *indifference*, $r(181) = -.149$, $p = .045$, was associated with a lower negative response. Similarly, a higher *lack of care* about climate change was associated with a lower negative response, $r(181) = -.186$, $p = .012$. On a related note, those *underestimating* the threats of climate change were linked to lower negativity, $r(181) = -.191$, $p = .010$. Also, a higher *deemphasis* on climate change was linked to lower negativity, $r(180) = -.147$, $p = .048$. Similarly, higher *belittling* of the consequences of climate change was linked to lower negativity, $r(180) = -.218$, $p = .003$. Therefore, the more an individual typically utilized apathy-focused approaches toward climate change, the less negative they were about the unpleasant HU climate change exhibit.

Links between positive experiences and regulation during the most pleasant section

The COA (i.e. pleasant and community-focused) section of the exhibit was specifically studied to examine links between emotion regulation and positive affect. We found that several items that are part of the *eco-consciousness* approach[28] were positively associated with positive emotional experiences during the COA climate exhibit. These findings are presented in Figure 2(a), where all eco-consciousness approaches were positively linked to positive affect (evident by positive correlations presented). For example, those who reported *connecting with the environment* as a way to regulate their emotions reported higher positive responses, $r(179) = .388$, $p < .001$ section. Similarly, those who felt a *moral responsibility to engage* with climate change were related to positive emotions, $r(180) = .397$, $p < .001$. Likewise, *planning to problem solve* climate crisis for managing emotions around climate change was linked to the experience of positive affect during the community solutions section to address climate change ($r(179) = .377$, $p < .001$). Also, *eco-consciousness cognition* was linked to experiencing positive affect, $r(179) = .32$, $p < .001$. Finally, *environmental efficacy* was linked to positive affect, $r(180) = .462$, $p < .001$. Thus, overall eco-conscious cognition and behaviors intended to address climate change were associated with experiencing positivity to pleasant solution-focused content presented in the COA section of the exhibit.

Unsurprisingly, *apathy-related indifference* to climate change was inversely related to positive experiences during the COA section: $r(179) = -.255$, $p = .001$. This was the only apathy-related variable linked to pleasant content, and all others were insignificant. In contrast, items that encapsulated a *hope* approach were correlated with positive affect during COA. These included *hope in* humanity, $r(179) = .332$, $p < .001$ and *hope in scientists,* $r(180) = .299$, $p < .001$. It also included overall *hope in solution,* $r(179) = .456$, $p < .001$. Another proactive strategy, *spiritual practices* to regulate climate emotions, were linked to experiences of positive emotions during COA, $r(179) = .244$, $p = .001$. Note that these variables were not related to negative emotions during the HU portion of the exhibit. Thus, specific to COA (the most pleasant portion of the exhibit), proactive approaches like eco-consciousness, hope, and spirituality were positively linked to experiences of positive affect.

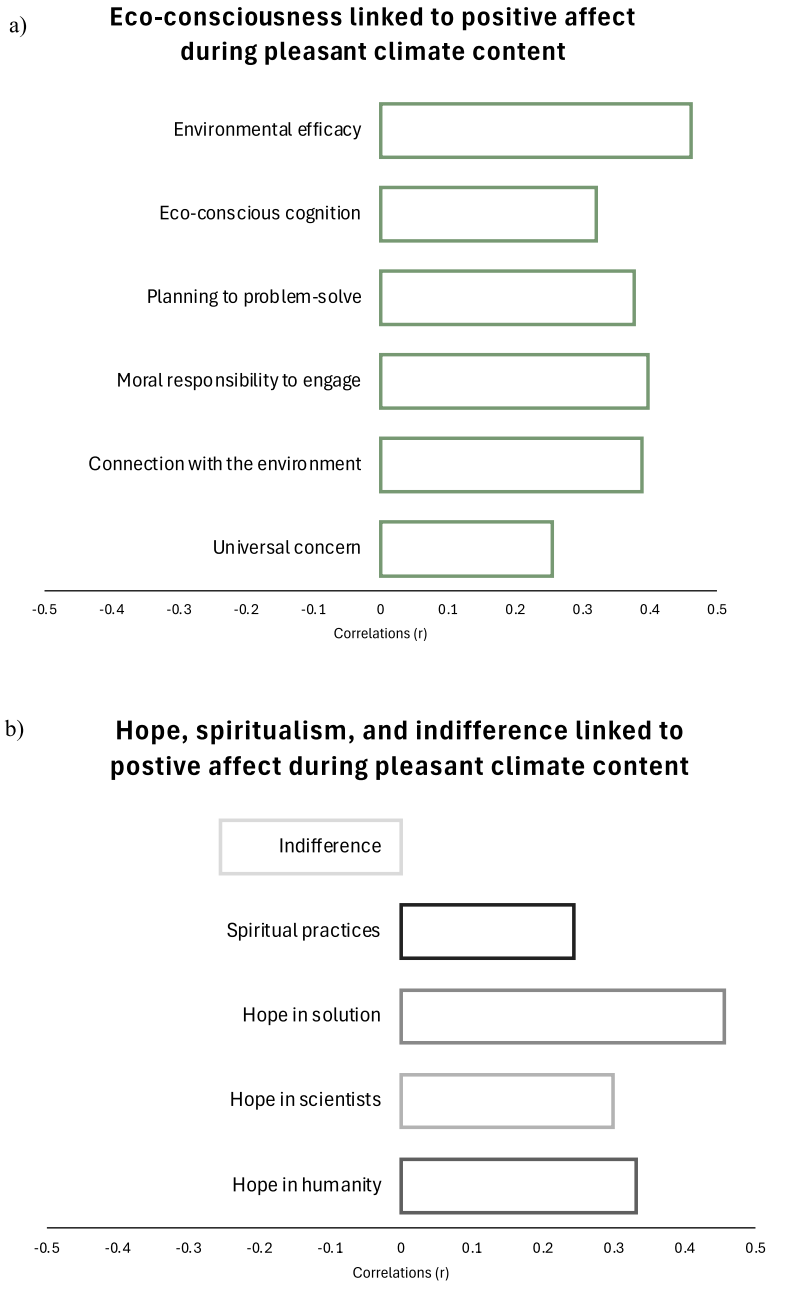

Figure 2. Emotion regulation strategies were linked to experiences of positive affect during the *Community-oriented action* (COA), the most pleasant section of the museum exhibit. (a) The figure shows the links between various eco-consciousness approaches and positive affect. The more an individual employed an eco-conscious disposition, the more an individual reported positive emotions in response to pleasant community-oriented content presented in the COA section (i.e. they moved together due to a positive correlation between eco-consciousness and positive affect). (b) The figure shows the relationship between an apathy-related approach (indifference), hope-related approaches (hope in humanity, scientists, and solution), and spiritual practices in the context of climate change. Apathy was inversely related, while hope and spirituality were positively related to experiences of positive affect during the COA exhibit.

Discussion

Climate change is a global and immediate threat to communities across the world;[29] however, in the U.S. (the world's second-largest emitter of greenhouse gases) a considerable proportion of people continue to be disengaged and dismissive of climate change.[30] The significance of the current study is that it utilized an informal learning environment of a natural history museum to learn about the museum visitors' emotional experiences and efforts to manage their emotions in the context of climate change. A novel contribution of this real-world science-based museum exhibit study is that it found a significant association between how individuals typically manage their responses to the climate crisis and their emotional reactions immediately after visiting a climate change exhibit. We found that museumgoers typically employing proactive regulation, such as eco-consciousness and hope, had strong emotional reactions to climate change information. Meanwhile, those employing an apathetic approach to climate change were linked to subdued emotional reactions. Therefore, negative reactions to the content of climate change museum exhibits should not be ignored, as they can be valuable. An emotional response to climate change content may be functional and helpful, especially if the emotional responses are managed by pro-environmental thoughts and behaviors to address climate action.

Proactive ways of eco-conscious regulation (including eco-conscious cognitions, moral engagement, planning, environmental efficacy, and connecting with the environment) were linked to more intense negative emotions. These findings are in line with past work that negative emotions in the context of climate change are found to inform pro-environmental action.[31] In fact, intense emotions around the climate crisis are necessary and even adaptive in manageable amount,[32] thus should not be considered maladaptive responses to the climate crisis.[33] Furthermore, it has also been considered that providing people with strong, positive experiences with nature may help promote desirable pro-environmental behaviors and proactive coping with environmental challenges.[34]

In contrast, we found that an apathetic approach to regulation in the climate change context (i.e. being indifferent, apathetic, belittling the climate change issue) was associated with muted emotional responses to climate change. Drawing from the affective science literature,[35] such a muted response in the current context may suggest low motivation to address the climate crisis. The reasons that contribute to apathetic approaches to dealing with climate change challenges remain to be understood. Addressing the broader implications, understanding when and how eco-conscious versus apathetic emotion regulation strategies are employed is particularly important for the design of effective climate communication practices, especially those that productively reduce fear without diminishing the feeling of urgency.[36] Thus, drawing advantages from the real-world museum setting, the current findings highlight the importance of effective regulation to promote a sustainable, climate-friendly approach. In terms of significance for museum practitioners, awareness of museumgoers' strong emotional reactions to climate content would be useful in planning ahead and providing opportunities to process emotions. These opportunities may involve available resources for connecting with the community and supporting climate action efforts, along with means for promoting personal wellbeing.

Limitations and future directions

These findings should be interpreted with the following limitations in mind. First, we asked participants about their typical ways of managing their affect in response to climate change. These provide important links with how people relate to climate change information. However, it would also have been helpful to know how people regulated their affect in real-time using EMA approaches.[37] Second, we learned about the participants' emotional reactions right after they had experienced the exhibit, but we do not know how the emotional reactions changed after the museum visit over the course of days, weeks, and months. Thoughtful longitudinal studies will need to be designed to gain an understanding of changes in emotional response to climate change over time.[38] Finally, it is also important to consider that individuals visiting a natural history museum may be more open to scientific information, and that may not represent the whole local community. Further work needs to be done to overcome such barriers to be able to collect data from other representative samples.

A museum's open and nonjudgmental context is useful for understanding how people feel about and deal with climate change.[39] While the current work explored several relevant regulation components, much more context-specific information remains to be explored to understand better how people cope with climate change distress. Participants may adopt several approaches to manage their emotions depending on their goals that need further exploration. In future work, it remains to be tested if and how those who have proactive approaches toward climate change are engaging with climate change. Literature on emotion regulation has shown that there are effective versus ineffective approaches to managing emotions. It remains to be determined which regulatory efforts are effective in managing climate change distress and, at the same time, promoting climate action. Moreover, negative emotions may be an important precursor to climate action, but they are certainly not enough to facilitate it.

Concluding remarks

Understanding how people manage their emotional reactions to climate change is crucial for *both* maintaining well-being and fostering openness to climate action, thus advancing future sustainability efforts. Overall, this study highlights the importance of embracing emotional reactions to climate change issues and the value of engaging in environment-friendly actions. Innovative approaches will be necessary to engage those who hold a dismissive and apathetic attitude toward climate change. Such solutions are important and urgent to slow down the fast trajectory of climate change.[40] The museum exhibits can provide a critical space to understand learners' complex emotional responses. Furthermore, the museum exhibits create an inclusive environment for learning about science-based topics and connecting with issues that impact the community. Being a trusted public institution of learning,[41] the museum environment can serve as a safe space to dismantle existing barriers to climate action and create pathways for the community to engage in climate-friendly actions.

Notes

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2. Clayton and Karazsia, "Development and Validation of a Measure of Climate Change Anxiety"; Clayton and Ogunbode, "Looking at Emotions"; and Pihkala, "Toward a Taxonomy."
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7. Haltinner and Sarathchandra, "Climate Change Skepticism."
8. Norgaard, "People Want to Protect Themselves a Little Bit"; and Stern, "Fear and Hope in Climate Messages."
9. Bradley and Reser, "Adaptation Processes in the Context of Climate Change."
10. Aldao et al., "Emotion Regulation Flexibility."
11. Kollmuss and Agyeman, "Mind the Gap"; Steg and Vlek, "Encouraging Pro-Environmental Behaviour"; Lohani et al., "Climate Change Is Linked to Daily Wellbeing"; Lohani et al., "Together, We Learn and Make a Difference"; and Lohani et al., "Development and Validation of ECO-SHADOW."
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13. Clayton and Karazsia, "Development and Validation of a Measure of Climate Change Anxiety."
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17. American Alliance of Museums, "Museums & Public Opinion."
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19. McGhie, "Evolving Climate Change Policy and Museums"; McGhie, Mander, and Underhill, "Engaging People with Climate Change"; and Newell, "Climate Museums: Powering Action."
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37. Kollmuss and Agyeman, "Mind the Gap."
38. Lohani and Blodgett, "Innovative and Ecological."
39. Katz-Kimchi and Atkinson, "Popular Climate Science and Painless Consumer Choices."
40. Hess and Maki, "Climate Change Belief."
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