



TRABAJO DE FIN DE MÁSTER

**Impact of digital exposure to nature on negative climate related
emotions and pro-environmental behavior: the role of nature
connection and restoration**

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Acknowledgements

A Eli, por aguantarme cuando me pongo irascible después de meterme en el hoyo del conocimiento. Espero que sea la primera de muchas investigaciones juntos.

A Pablo por las conversaciones de todo tipo de profundidad. Te aprecio amigo.

A Rocío y Sílvia por el marco del proyecto, que me ha permitido alcanzar cotas de complejidad insospechadas. Gracias también por las amplias correcciones que han mejorado mucho el trabajo. A Mars por la amabilidad a lo largo del proceso y por dejarme usar su experimento. A Pablo Nájera por su disponibilidad.

A todos y todas l@s profesores que me han inspirado y alimentado la curiosidad.

A mi familia, por estar a su manera cada un@.

Al grupo de compañer@s de Comillas, en especial Hernán, Sara y el resto de psicofamily.

RESUMEN

Las soluciones basadas en la naturaleza son una estrategia importante para abordar la crisis climática. El objetivo de este estudio fue evaluar el efecto de la exposición digital a la naturaleza sobre las emociones negativas relacionadas con el clima y el comportamiento proambiental a través de la restauración psicológica y la conexión con la naturaleza. Un total de 1000 estudiantes de universidades españolas participaron en un diseño 2 (tiempo) por 3 (grupo: naturaleza vs. urbano vs. neutral). La exposición digital a la naturaleza tuvo efectos directos significativos en la reducción de las emociones negativas relacionadas con el clima y en el aumento de la restauración percibida, pero no en el aumento del comportamiento proambiental. La restauración medió el efecto de la exposición a la naturaleza sobre las emociones negativas relacionadas con el clima. La conexión con la naturaleza no medió el efecto de la exposición a la naturaleza ni sobre las emociones negativas relacionadas con el clima ni sobre el comportamiento proambiental, aunque sí contribuyó a predecir directamente el comportamiento proambiental. La condición urbana resultó en un ligero aumento de las emociones negativas relacionadas con el clima y en niveles bajos de restauración. La condición neutral, comparada con la condición de naturaleza, produjo menor restauración y un descenso en las emociones negativas relacionadas con el clima similar. Estos hallazgos apoyan la existencia de factores restauradores diferenciales dentro de los estímulos de naturaleza. También corroboran la dificultad de manipular experimentalmente la conexión con la naturaleza, así como su rol predictor sobre el comportamiento proambiental. Aunque futuros estudios son necesarios para concretar las rutas y relaciones de estas variables, los hallazgos encontrados refuerzan la posibilidad de usar el contacto digital con la naturaleza para regular las emociones negativas con el cambio climático.

Palabras clave: soluciones basadas en naturaleza, comportamiento pro-ambiental, emociones negativas relacionadas con el clima, conexión con la naturaleza, restauración psicológica

ABSTRACT

Nature-based solutions are an important strategy to address the climate crisis. The aim of this study was to evaluate the effect of digital exposure to nature on negative climate-related emotions and pro-environmental behavior through psychological restoration and nature connection. A total of 1,000 students from Spanish universities participated in a 2 (time) \times 3 (group: nature vs. urban vs. neutral) design. Digital exposure to nature had significant direct effects on reducing negative climate-related emotions and increasing reported restoration, but not on increasing pro-environmental behavior. Restoration mediated the effect of nature exposure on negative climate-related emotions. Nature connection did not mediate the effect of nature exposure on either negative climate-related emotions or pro-environmental behavior, although it did contribute to directly predicting pro-environmental behavior. The urban condition resulted in a slight increase in negative climate-related emotions and low levels of restoration. The neutral condition, when compared to the nature condition, produce smaller restoration effects and a similar decrease in negative climate-related emotions. These findings support the existence of differential restorative factors within nature stimuli. They also corroborate the difficulty of experimentally manipulating nature connection, as well as its predictive role on pro-environmental behavior. Although future studies are needed to clarify the pathways and relationships among these variables, the findings reinforce the possibility of using digital nature contact to regulate negative emotions related to climate change.

Keywords: nature-based solutions, pro-environmental behavior, negative climate-related emotions, nature connection, psychological restoration

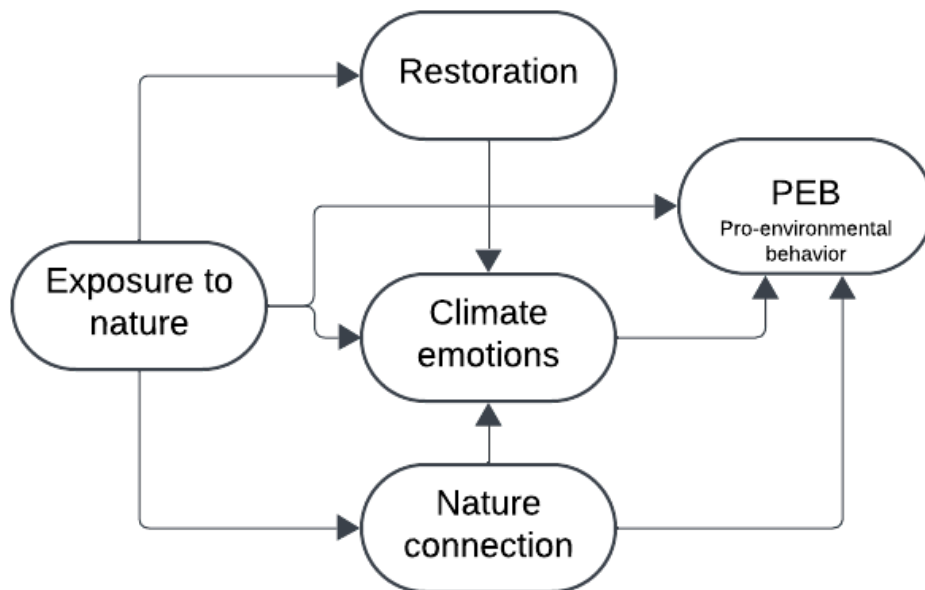
1. INTRODUCTION

Nature-based solutions [NbS] are actions inspired by and/or supported by nature that seek to face environmental challenges in a way that provides benefits in health, social, environmental and economic terms (ECDG, 2015). NbS is a multidisciplinary field that includes economics, education, biology and psychology. In psychology, NbS uses both digital and actual nature as a way to harness the benefits of nature contact, such as the strong positive correlation between natural environments and mental health and well-being (Van Den Bosch & Ode Sang, 2017).

Previous evidence also shows that contact with nature increases levels of subjective well-being and positive affect, reduces stress (Fan & Baharum, 2024) and improves human cognition (Pasca et al., 2022). In particular NbS such as ecotherapy have been used as a way to mitigate the psychological impact of climate change, specifically climate related emotions such as eco-anxiety (Baudon & Jachens, 2021). Furthermore, NbS could be a way to bring climate related emotions to within an adaptive range that enhances coping which includes pro-environmental behavior (Klein & Hilbig, 2018; Stanley et al., 2021). NbS has also been related to nature connection, a variable linked to both climate emotions and pro-environmental behavior (Mackay & Schmitt, 2019a).

Overall, these relationships create a complex network of interactions (see Figure 1 in the following page) that is the focus of recent research in the field (Ágoston et al., 2024; Corvello et al., 2025; Stanley et al., 2021). The present study aims to examine the direct effects that digital nature exposure has on negative climate related emotions, pro-environmental behavior and restoration. It also aims to study the role of nature connection and restoration as process variables within this web of relationships.

Figure 1

Conceptual Framework

Note. Own elaboration.

1.1 Climate change and negative climate related emotions

The very nature that is the substrate of NbS is being damaged by human action, resulting in climate change. Climate change is a scientifically established phenomenon that involves a number of processes including but not limited to: global warming, an increase in extreme weather events, threat of loss of biodiversity and forced displacement (Mento et al., 2023). In humans, climate change has effects on physical, social and mental health, with the latter coming more into focus in recent years. There are three pathways through which mental impact takes place: direct exposure to climate-related extreme events; indirect exposure to the impact from such events; and the awareness of climate as well as vicarious experience of its effects (Cosh et al., 2024) This last path is related to a plethora of negative emotions such as anger, despair, sadness, etc., which have been grouped under the umbrella term of negative climate-related emotions. Additionally, specific terms have been put forth: eco-anxiety, eco-grief, solastalgia, eco-angst, ecological stress, eco paralysis, and

environmental distress among others (Coffey et al., 2021). Despite efforts to standardize how these emotions are defined and named (Mento et al., 2023; Pihkala, 2022b); there is a continuing risk of jingle and jangle fallacies and parallel investigation due to the existence of many words to designate the same construct and, in reverse, many constructs that refer to different phenomena depending on the authors using them (Cosh et al., 2024). In particular, eco-anxiety is often used interchangeably with negative climate related emotions (Cosh et al., 2024). Hence, in their systematic scoping review, Coffey and his team (2021) found that eco-anxiety is most frequently operationalized as a broad range of negative emotions related to climate change that include a link to anxiety as a state of negative emotion encompassing physical symptoms and fear of the future. The present study seeks to avoid this metonymy and thus uses negative climate related emotions [NCRE] as an umbrella term that subsumes discrete eco-emotions such as eco-grief, eco-anger, eco-anxiety and solastalgia among others.

Another area of debate around the topic is whether these emotions can be part of an adaptive coping response based on a rational concern, and if, at the other end of the spectrum, they can be understood as an anxiety disorder or subtype of a disorder (Mento et al., 2023). Several studies have found that, within adaptive ranges, climate related emotions are related to pro-environmental behavior (Ágoston et al., 2024; Corvello et al., 2025; Stanley et al., 2021).

1.2 Pro-environmental Behavior

Pro environmental behavior [PEB] refers to the commission or omission of behavior that aims to consciously either benefit the environment or minimize the negative impact on it (Lange, 2024; Tian & Liu, 2022). PEB is divided into two categories of behaviors: public, which aim to reduce society's collective environmental impact (e.g., donating to an organization, attending a demonstration); and private, which

aim to reduce one's own environmental impact (e.g., recycling, buying seasonal and local produce). Each category is influenced by different goals, motivations and contextual factors. These factors are divided into external and individual (demographic and psychological) categories, with the relative importance of each of these variables over PEB still unclear (Li et al., 2019). Nonetheless, PEB has shown strong correlations with variables including attitudes, moral norms, social norms, guilt, eco-anxiety [sic] and nature connection (Mackay & Schmitt, 2019a). Also, the popularization of the construct has been parallel to a proliferation of measuring techniques (Lange, 2024). However, pro environmental intentions are often used to measure PEB. Despite being highly correlated, this tends to lead to over-estimates of PEB when compared to data obtained through direct observation methods (Mackay & Schmitt, 2019a). Nonetheless, there is an ongoing effort to increase the validity and reliability of available tools (Lange, 2024; Tian & Liu, 2022). Such efforts are also prevalent in one of the variables that has repeatedly been associated with PEB: nature connection.

1.3 Nature connection

The connection between humans and nature is a core theme in ecopsychology and has been deemed as a key factor in addressing the environmental crisis. Over the years, several constructs such as commitment to nature, connectedness to nature, connectivity with nature, environmental identity, nature relatedness and inclusion of nature in self [INS] have been used by researchers. Tam (2013) showed that, despite subtle useful divergences, the presence of a strong convergent validity and little incremental validity among these concepts makes it possible to see them as markers of the same underlying construct: nature connection [NC]. NC alludes to the degree to which nature has been included in a person's identity, resulting in a sense of "oneness" with nature (Whitburn et al., 2020).

Previous studies posit NC as part of identity, making it a stable trait (Tam, 2013; Wesley Schultz, 2001; Whitburn et al., 2020). However, there are also recent studies that aim to change it experimentally with exposure to nature that last from just a few minutes (Abass & Zelenski, 2025; Pasca et al., 2022; Soliman et al., 2017) to several hours (Choe et al., 2025; Colléony et al., 2020). Considering this theoretical tension, some authors propose a dual nature of NC as both a stable trait with temporary state fluctuations (Abass & Zelenski, 2025; Colléony et al., 2020; Hanley et al., 2022). Manipulation of NC as a state can occur through physical or digital exposure to nature, and self-reflection or self-categorization with respect to nature. However, experimental manipulation often fails. Mackay & Schmitt (2019) propose inappropriate targeting of the construct as a likely reason behind this.

As for the relationship between NC and PEB, recent meta-analysis found a strong correlation, similar to that of the most strongly correlated variables to PEB such as attitudes, moral norms, social norms, and guilt. NC's correlation was robust across a number of variables (age, gender, nationality, ethnic diversity), yet a significant difference was found between university students, who scored higher, and non-university samples (Guazzini et al., 2025; Mackay & Schmitt, 2019a). Also, the strength of the relationship may differ depending on the measure used for NC (Tam, 2013). Additionally, the causal effect of NC on PEB has been examined, coming out as weak. Mackay and Schmitt (2019) propose that this is because attempts to experimentally manipulate NC are often unsuccessful because they do not target identity, but rather exposure to nature. Lastly, NC has also been examined as a mediator of the effect of nature exposure on PEB, both in its trait form (Whitburn et al., 2019) and its state form (Zelenski et al., 2015a).

Hence, beyond understanding the direction of the relationship between NC and PEB, researchers are focusing on the dual nature of NC and on how NC and

climate related emotions can be manipulated to increase PEB. Exposure to nature, a key aspect of NbS, is one promising avenue.

1.4 Nature based solutions (NbS)

Evidence coming from previous meta-analyses shows that contact with nature has significant positive effects on physical, mental and social health (Barragan-Jason et al., 2023). Nonetheless, several themes within the field are still open to research. First, whether the various forms of digital exposure have the same effects as exposure to real nature. Studies of digital exposure have shown that it frequently decreases negative affect, reduces stress, increases relaxation, and has restorative qualities, but has had mixed results in increasing positive affect and no effect on cognitive performance, while NC is suggested to increase but is in need of further studies (Spano et al., 2023).

Also, the meta-analysis by Fan & Baharum (2024) supported previous research by reporting that both physiological and subjective levels of stress were reduced with nonsignificant differences between actual and digital nature. Hence, although the authors pointed to the need for further research to clarify if the similarity persisted with different outcomes, their results support the use of digital exposure to access the benefits of contact with nature. In this context, the use of digital exposure in the present study is further warranted due to its advantages over actual nature in terms of accessibility and ease of experimental control. These advantages also speak to the proliferation of experiments that have used digital exposure to nature in a variety of ways in recent years.

This proliferation has also opened the door to question if the different types of digital exposure have comparable effects. Table 1 in the next page summarizes the experimental studies that informed the present design. The table includes the type of exposure used, including device, duration of exposure, comparison conditions and

key dependent variables. These studies were selected on four converging criteria. First, all employed digital exposure to nature. Second, all used brief single-session exposures. Third, all relied on a between-subjects contrast between at least one nature condition and one non-nature condition (typically urban) and sometimes complemented by a neutral condition. Fourth, the variables of interest include those present in the current study. Within this selection of literature, Zelenski et al. (2015, Study 2), Yang et al. (2020, Study 4), and Moll et al. (2025) constitute the three direct precedents for the exact nature–urban–neutral three-level structure adopted in the present study.

This type of structure is designed to address another open question within the field: the comparison between natural and urban environments. This comparison is especially relevant due to the shifts of population from rural to urban setting that have taken place in the last century. Research has found that either spending time outdoors and/or visual contact with nature has greater restorative effects than contacting urban environments (Collado et al., 2017). For example, social cohesion increases more if a search task takes place in a natural environment (Henderson et al., 2024). Also, ostracized participants who viewed nature pictures reported lower aggression responses than those who viewed urban pictures (Poon et al., 2016), as well as higher positive affect and perceived social competence (Moll et al., 2025).

With regards to NC and PEB, Soliman et al. (2017) found that exposure to digital nature increased NC when compared to exposure to built environments, but they did not observe a significant impact on PEB. The result on PEB contrast with a previous study (Zelenski et al., 2015b). Klein and Hilbig (2018) argue that these differences are due to methodological aspects where PEB is confounded with other variables, yet their own experiment found that virtual exposure in itself may not be

enough to foster PEB, but it could do so under certain conditions. Overall, these results highlight the need for further research, which our study aims to be part of.

Lastly, research has explored the mechanisms underlying the effects of nature contact on people's psychological wellbeing, with the framework of restoration featuring prominently.

1.5 Psychological restoration theories

Restoration, together with stress and coping, is a central component of adaptation processes. Restoration refers to the process of recovering psychophysiological and cognitive resources that have been drained by everyday life demands (Hartig, 2021). There are two seminal theories in the field. On one hand, the stress reduction theory (Ulrich, 1983) posits that nature's restorative effects on psychophysiological stress is the result of our evolutionary history in which natural environments are associated with resources necessary for life, and thus activate a basic sense of security. On the other hand the attention restoration theory (Kaplan & Kaplan, 1989) argues that restoration takes place mainly due to the recovery of directed attention, the ability to concentrate and block distractions that gets depleted as attentional fatigue builds. For restoration to occur, an environment has to be fascinating, provide the sensation of being away, have a certain degree of extension and coherence, and be compatible with the individual's inclination. However, there have been proposals to widen the focus on restoration processes by including new levels of analysis such as the relational and community (Hartig, 2021) and to give more consideration to the social aspect of restoration (Collado et al., 2017).

Table 1*Summary of Experimental Studies on Digital Nature Exposure*

Study	Exposure Type	Medium / device	Duration	Comparison condition(s)	Key DV(s)
Zelenski et al. (2015) — Study 1	Documentary video with narration and music	Desktop computer and headphones	12 min	Two levels: nature (<i>Planet Earth</i> excerpt) vs. built (<i>Walks with an Architect</i> , New York City)	Cooperation/sustai nability (FISH commons dilemma), mood, INS
Zelenski et al. (2015) — Study 2	Documentary video	Desktop computer and headphones	12 min	Three levels: nature vs. built (architecture) vs. neutral (iTunes visualizer with grammar podcast)	FISH outcomes, mood
Zelenski et al. (2015) — Study 3	Short videos	Online (Qualtrics)	2 min	Four conditions: pleasant nature, unpleasant nature, pleasant built, unpleasant built.	SVO, willingness to behave sustainably, mood, INS
Soliman et al. (2017)	Video with audio	Desktop monitor vs. VR head- mounted display	4 min	Two levels × two devices: nature vs. built/urban; no neutral condition	NC (INS + NR), mood, PEB
Klein & Hilbig (2018) — Exp. 1	Video clips with calm instrumental music	Lab computer	2 min 17 s	Three levels: nature vs. social interaction vs. urban (control)	PEB and cooperation in GGG
Klein & Hilbig (2018) — Exp. 2	Picture videos with parallel themes	Lab computer	2 min 17 s	Three levels: intact nature vs. destroyed nature vs. urban (control)	PEB and cooperation in the Greater Good Game

Study	Exposure Type	Medium / device	Duration	Comparison condition(s)	Key DV(s)
Yang et al. (2020) — 4 studies	Static photographs (slideshow)	Computer screen	≥ 1 min 10 s	Varies across studies: nature vs. urban (Study 1); trees vs. oceans vs. urban (Study 2); trees vs. oceans vs. mountains vs. urban (Study 3); nature vs. urban vs. neutral (Study 4)	Affect balance, basic emotional needs satisfaction, self-esteem, social pain
Pasca et al. (2022) — Study 1	Static photographs (Slideshow punctuated by measures)	Computer screen, full-screen mode	2 min 30 s	Three within-category levels: totally natural vs. quasi-natural vs. non-natural (urban); no neutral condition	INS, CN, PA/NA, well-being, preference
Moll et al. (2025)	Static photographs (slideshow)	PowerPoint projected on a large classroom screen	2 min 20 s	Three levels: natural vs. urban vs. neutral (geometric symbols)	Positive affect, perceived social competence, attention, RR
Present study	Digital — still images with congruent ambient audio	Computer, tablet, or smartphone with headphones	3 min 10 s	Three levels: nature vs. urban vs. neutral	NCRE, PEB, NC, RR

Note. NC = nature connection; INS = inclusion of nature in self; NR = nature relatedness; PEB = pro-environmental behaviour; RR = reported restoration; NCRE = negative climate-related emotions; PA/NA = positive/negative affect; CN = connectedness to nature; SVO = social value orientation; VR = virtual reality; GGG = Greater Good Game

Given the above, the current study aims to extend previous research by examining the effect of exposure to digital nature on negative climate related emotions and PEB. Moreover, we explore whether these relationships are mediated by NC and reported restoration. We do this by conducting an experiment in which one third of the participants will be exposed to digital nature stimuli, another third to urban stimuli and the last third to neutral stimuli.

1.6 Objectives and hypotheses

Objective 1: Examine the direct effects of digital exposure to nature on negative climate-related emotions, pro-environmental behavior and reported restoration. Considering the findings described above, we expected that participants exposed to digital nature images and sounds (experimental condition), compared with participants exposed to digital urban/built environments images and sounds (control condition A) and with participants exposed to neutral images and sounds (control condition B), would:

H.1.1 experience a larger decrease in negative climate-related emotions after being exposed to the nature stimuli and sounds than to urban or neutral stimuli

H.1.2 report larger levels of restoration after being exposed to nature stimuli than to urban or neutral stimuli

H.1.3 experience a greater increase in pro-environmental behavior after being exposed to nature stimuli than to urban or neutral stimuli.

Objective 2: Examine the mediating role of nature connection and reported restoration in the effect of exposure to digital nature on negative climate related emotions and pro-environmental behavior.

H.2.1 Effects of digital exposure to nature on negative climate related emotions will be mediated by nature connection (H 2.1.1) and reported restoration (H 2.1.2)

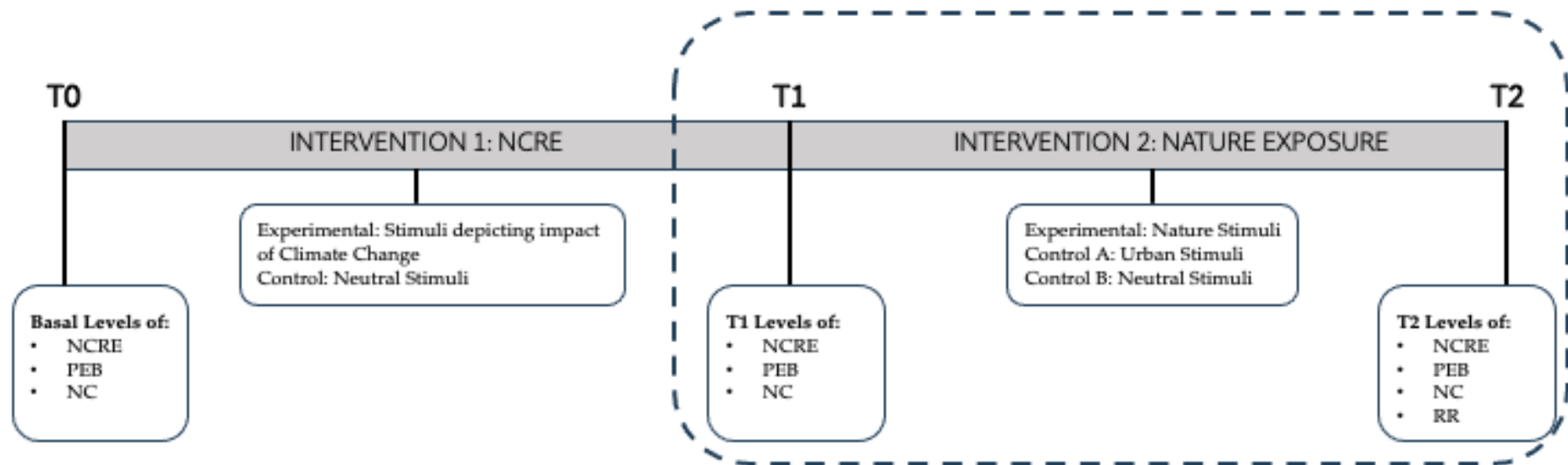
H 2.2 Effects of digital exposure to nature on pro-environmental behavior will be mediated by nature connection.

2. METHOD

2.1 Design

The present study is part of a larger randomized controlled trial, which employed a 2 x 3 mixed factorial design with two interventions (ITV1, ITV2) temporally located between three measurement points (T0, T1, and T2). Figure 2 in the next page visually represents the design.

In the first intervention (ITV1) participants in the experimental group were exposed to a video (images with a narrated audio) depicting the negative impact of climate change, whereas the control group was exposed to stimuli of neutral arousal and valence (e.g image of a symbol and white noise). The current study focuses on the second intervention (ITV2; T1 to T2), which examined the effects of exposure to digital nature (independent variable) on the dependent variables: negative climate related emotions [NCRE], pro-environmental behavior [PEB], nature connection [NC] and reported restoration. Nature connection and restoration were also tested as mediating variables. For ITV2, participants from ITV1 were randomly assigned to the one experimental group (images and sounds of nature), or either of the two control groups: A - urban (urban images and sounds of cityscapes) or B - neutral (images of black simple symbols against a white background and white noise). These combinations resulted in 6 groups (Table 2, p. 21). The effects of prior exposure to ITV1, as well as age and gender, were included as covariates. This design was piloted for feasibility in a sample of 119 university students. The study was approved by the Ethics Committee of Universidad Pontificia Comillas (Ref. 109/24-25).

Figure 2*Experimental Procedure*

Note. Dotted line indicates the focus of the present study. NCRE = Negative Climate Related Emotions; PEB = Pro-Environmental Behavior; NC = Nature Connection; RR = Reported Restoratio

Table 2*Experimental Groups*

Group	Video T1	Video T2
Group 1	CC Impact	Nature
Group 2	CC Impact	Urban
Group 3	CC Impact	Neutral
Group 4	Control	Nature
Group 5	Control	Urban
Group 6	Control	Neutral

Note. CC = Climate Change

2.2 Participants

A total of 1056 participants were recruited (see Table 3 , p. 29, for a full description). We used a convenience sampling strategy with cluster access via academic institutions. First, we contacted the heads of study departments in several educational institutions. Those department chiefs then facilitated access to teachers, who allowed us to run the study during regular class time. Participation within each classroom was still voluntary, and students completed the study individually on their own devices.

The criteria of inclusion were being 18 years of age or older and being enrolled in a university undergraduate degree. The criteria of exclusion included: not having bilingual proficiency in Spanish, being enrolled in a different kind of degree. 56 participants did not meet the requirements and were excluded.

2.3 Procedure

Random assignment was implemented through simple randomization at the individual level within each classroom. Before beginning the experiment, the researcher distributed papers numbered from 1 to 6, each corresponding to one of the six experimental conditions. Each student took one paper at random, which determined their condition. Table 2 above shows the resulting groups. Participants then proceeded to a questionnaire on the Google Forms platform. Participants were asked to complete the questionnaire using their personal computer, tablet or smartphone, in all cases wearing headphones. First, participants were informed of confidentiality and gave their informed consent (Annex 1). They were then presented with questions relative to their personal characteristics, followed by the procedure in Figure 2 (p. 20) which included the questionnaires detailed on section 2.4. Upon completion, a short debrief explaining the different levels and variables measured took place. The entire procedure took around 35 minutes. All materials and procedures took place in Spanish.

2.4 Materials

2.4.1 Videos: experimental and control

The stimuli consisted of videos of 3 minutes and 10 seconds. Each video had 19 images of 10 second duration each. The images (Figure 3 below) were accompanied by sounds: nature images with nature sounds such as those in a forest, the neutral images (black symbols against a white background) with white noise and the urban images with cityscape such as traffic. See table 2 on the previous page for the combination of videos that each group watched. Participants watched the videos in their individual device with earphones.

Figure 3

ITV2 Intervention Images



Note. Left to right: Nature – Neutral – Urban Conditions. Each was accompanied by sounds: nature (forest) – white noise – urban (traffic)

In order to increase replicability, these images were sourced from Moll et al. (2025), whom had in turn culturally adapted them to a Spanish population of students from Yang et al (2021). Moll et al. (2025) employed them on a study on the effect of digital exposure to nature to mitigate the effects of ostracism. However, the present study incorporated sounds to the videos: forest soundscapes with birds chirping in the nature condition; city soundscapes with bustling voices and traffic in the urban condition; and white noise in the neutral condition. Furthermore, the sounds in the neutral condition were modified to incorporate comments made in the pilot of the study.

2.4.2 Measures

2.4.2.1 Negative climate related emotions.

The negative climate related emotions questionnaire [NCREQ] was first used by Ogunbode et al. in 2022 and later refined in 2023. Its focus is on current negative climate related emotions. Participants have to indicate how much they feel at the moment of answering each of seven negative climate-related emotions: calm, tense, relaxed, anxious, peaceful, worried and terrified. Each emotion is measured with 1 item. Items are rated on a 5 point likert-scale ranging from “not at all” (1) to “extremely” (5). Items on “calm”, “relaxed” and

“peaceful” are reverse-coded. A higher overall score reflects higher levels of distress related to climate. In Ogunbode et al (2023) the scale showed adequate internal consistency ($\alpha = .72-.92$) in samples across 25 countries. Additionally, convergent validity has been supported through positive associations with insomnia (Ogunbode et al., 2023) and psychological distress, and negative associations with subjective wellbeing (Ogunbode et al., 2022; Ogunbode et al., 2023). In the present study, the scale demonstrated good internal consistency (Cronbach’s $\alpha = .90$), with item–total correlations ranging from .58 to .75, indicating adequate homogeneity across items. For use in the present study we conducted a back-to-back translation of the items with the assistance of a bilingual English and Spanish speaker. Refer to Annex 2 for the full questionnaire.

2.4.2.2 Pro Environmental Behavior.

PEB was measured using the Pro-Environmental Intentions scale [PI] developed by Kotyza et al. (2024), who adapted items on visit intention originally employed by Han et al. (2010) to measure hotel customers' intentions to visit a green hotel. Han et al. had in turn adopted validated items assessing behavioral intention from the Theory of Planned Behavior [TPB] (Mathieson, 1991). The scale has three items, to which participants have to indicate the degree to which they disagree or agree on a 7 point Likert scale (1 I strongly disagree - 7 I strongly agree). Kotyza considered the sum of the scores for each item as a total score representative of intention to protect the environment. Kotyza et al. (2024) employed PI in multi-country research that included 2,702 university students from six European countries. The Spanish subsample comprised 14.9% of the sample. Cross-country comparisons revealed that the Spanish sample scored significantly lower on PI than 4 of the other 6 countries, although the SEM structure was invariant across

countries and no cross-country differences in the structural paths were statistically significant. Additionally, the PI construct showed adequate convergent validity with perceived behavioral control, environmental concern and social norms [related to environmental behaviour] (Kotzya 2024). Neither Kotzya (2024), Han (2010) or Mathieson 1991 reported other validity or reliability properties. In the present study, the PI scale exhibited excellent internal consistency (Cronbach's $\alpha = .94$), with item-total correlations ranging from .86 to .90, indicating a high degree of homogeneity across items. Refer to Annex 3 for the full questionnaire.

2.4.2.3 Nature Connection.

Nature connection was assessed using the Inclusion of Nature in Self scale [INS] (Schultz, 2001). The INS is a single-item graphic measure adapted from Aron et al.'s (1992) Inclusion of Other in the Self scale. Participants select from a series of seven Venn-like diagrams depicting varying degrees of overlap between two circles labeled "Self" and "Nature," ranging from no overlap (1 = complete separation) to complete overlap (7 = full interconnectedness). Higher scores indicate greater perceived cognitive connectedness with the natural environment. As a single-item measure, the INS does not permit traditional internal consistency estimates. However, the scale has demonstrated adequate psychometric properties through appropriate alternative approaches (Allen et al., 2022). The initial deployment showed adequate test retest reliability ($\alpha = .90$ at 1 week; $\alpha = 0.84$ at 4 weeks), high criterion validity, and moderate structural validity; although its overall quality has been deemed to be doubtful (Tiscareno-Osorno et al., 2023) Later, Kossack and Bogner (2012) confirmed the reliability of the INS as a rapid assessment tool for measuring shifts in nature connectedness in educational settings. Also, the INS has shown consistent convergent validity

with multi-item nature connectedness scales such as the Environmental Identity Scale and the Connectedness to Nature Scale, including among Spanish Speaking samples (Olivos et al., 2011). Additionally, the INS has been found to predict PEB (Olivos et al., 2011). Refer to Annex 4 for the full questionnaire.

2.4.2.5 Reported Restoration.

Reported restoration was measured using four items employed by Moll et al. (2025). These items are originally found in Staats et al. (2003), who designed them to capture participants' subjective perception of psychological recovery after exposure to environmental stimuli within the framework of Attention Restoration Theory (Kaplan & Kaplan, 1989). Responses are recorded using a Liker-type scale ranging from one (Totally disagree) to 5 (Totally agree). The mean of the four items is taken to be an indicative of the reported level of restoration. No formal cross-cultural validation study of this specific 4-item scale has been published to date. Moll et al. (2025) applied it to a sample of Spanish teenagers in the context of an ostracism and nature exposure experiment with good internal consistency (Cronbach's $\alpha = .91$). In the present study, the RR scale showed good internal consistency (Cronbach's $\alpha = .87$), with item-total correlations ranging from .61 to .80, suggesting satisfactory homogeneity among items. Refer to Annex 5 for the full questionnaire.

2.5 Data analysis

Statistical analyses were performed using JASP as developed by University of Amsterdam in its version 0.95.4 (Intel) for MacOS. The level of significance was established at $p < 0.05$. Descriptive statistics were reported using mean, dispersion and frequency measures. The focus of the present paper was the impact of ITV2. The direct relationships between variables in objective 1 were accounted for using analyses of variance. The entire dataset was employed, since this allowed

to account for the effect of having gone through ITV1 by including T0 as a covariable. Repeated measures ANOVA were used in the case of PEB and NCRE, while between subjects ANOVA was used for RR. Assumptions of sphericity and homogeneity were tested before the analysis. Once satisfied, simple effects were assessed through estimated marginal means. Main effect for the within subjects and between subjects factors, as well as interaction effects, were analyzed through the F statistic, which determined if the changes were statistically significant with respect to the null hypothesis. Effect sizes were reported using ω^2 . Where appropriate, post hoc analysis with Holm corrected p -values were employed to identify specific significant differences. Descriptive plots were used to visually represent the information. Lastly, sensitivity analysis were conducted to assess the robustness of the results by analysis device type (smartphone, computer, tablet) as a between-subjects factor. Additionally, mediation analyses were conducted using structural equation modeling (SEM) in JASP. Indirect effects were estimated using maximum likelihood estimation with bias-corrected bootstrap confidence intervals (5000 resamples). Separate and parallel mediation models were tested to assess the mediating role of nature connectedness and reported restoration on the relationship between digital exposure to nature and the outcome variables. Baseline (T1) levels of the mediator and outcome variables were included as covariates to control for pre-intervention differences.

3. RESULTS

3.1 Descriptive Statistics

3.1.1 *Demographic Variables*

A total of 1056 participants provided valid responses. 56 participants did not meet the requirements and were excluded. Out of the remaining 1000, most identified as women (81.6%), with a mean age of 19.9 ($SD = 2.79$). 1.2% belonged to an environmental association, while political orientation was balanced across the ideological spectrum, with higher concentrations in moderate positions on both the left and right and 25.2% choosing not to answer or being unsure of their affiliation. The sample was skewed toward earlier years of study, with a steady decline in representation across successive academic years. Most participants completed the survey using a computer (64.8%), followed by a smartphone (21.0%) and a tablet (14.2%). Table 3 in the next page provides complete data on gender, belonging to environmental associations, year of studies, and kind of device used to complete the experiment for the entire sample. It also contains said information for the subsample used in mediation analysis. This subsample is comprised of groups 1, 2 and 3: participants who were exposed to the experimental condition (video of images and narration of the impact of climate change) in ITV1. There were no statistically significant differences between the whole sample and the subsample for any sociodemographic variable.

Table 3*Sociodemographic Variables*

Variable	Whole Sample		Groups 1,2,3	
	Frequency	Percentage	Frequency	Percentage
Gender				
Feminine	816	81.6	412	80.6
Masculine	169	16.9	91	17.81
Non binary	14	1.4	8	1.57
Other	1	0.1	0	0.0
Environ. Association				
Yes	12	1.2	7	1.6
No	988	9.8	504	98.6
Political Affiliation				
Left	314	35.1	177	34.6
Right	329	36.7	186	36.4
Unsure	152	17.0	85	16.6
Prefer not to answer	101	10.2	65	12.3
Year of studies				
1	364	36.4	193	37.8
2	283	28.3	130	25.5
3	164	16.4	95	18.6
4	136	13.6	69	13.5
5	49	4.9	24	4.7
N/A	4	0.4	0	0.0
Kind of device				
Smartphone	210	21.0	115	22.5
Computer	648	64.8	315	61.64
Tablet	142	14.2	81	15.85

Note. Valid percentages were used. Variables in which the addition of percentages results in values under 100 indicates that some participants chose not to answer that question.

3.1.2 Descriptive statistics of NCRE, NC, RR and PEB

Descriptives statistics for the dependent variables at T1 and T2 are found in Table 4. The urban and neutral condition were kept as separate conditions since results were significantly different, which is opposite to what both Yang et al. (2021) and Moll et al. (2025) found.

Table 4

Descriptive statistics [Mean (Standard Deviation)] of NCRE, PEB and RR before (T1) and after (T2) video exposure

Variable	NCRE		PEB		RR	
	T1	T2	T1	T2	T1*	T2
Nature	2.99 (.86)	2.65 (.86)	5.77 (.92)	5.82 (1.03)	n.a	3.50 (.80)
Urban	2.94 (.88)	2.98 (.83)	5.77 (.87)	5.81 (.94)	n.a	2.30 (.82)
Neutral	2.92 (.89)	2.75 (.83)	5.75 (.89)	5.83 (.89)	n.a	2.67 (.82)

Note. *= Reported Restoration was not measured at T0 and T1, only at T2.

3.2 Effects of video intervention on negative climate related emotions, pro-environmental behavior and reported restoration

3.2.1 Assumptions

Assumption testing for the data regarding NCRE, PEB and RR was performed before carrying out the analysis. First, sphericity was automatically satisfied because the within-subject factor had only two levels. Second, Q-Q plot analysis revealed no deviations from normality in the case of NCRE, while RR showed minor tail deviation. However, PEB did present a few extreme outliers. Boxplot inspection revealed that these outliers were distributed across all groups. Considering sample size, the deviation in RR and outliers in PEB were not

considered to meaningfully influence results and thus were retained. Lastly, Levene's test for equality of variance was met across all variables with the exception of NCRE at T2. Boxplot analysis showed that the urban condition presented more clustering around mid-values in addition to the presence of some low-end outliers. However, inspection of group standard deviations suggested minimal differences in variability. In conjunction to the large and group-balanced sample, the violation was considered not meaningful.

3.2.2 Analysis of Variance

Repeated measures ANOVAs were conducted to examine the effect of the second intervention (ITV2; nature vs. urban vs. neutral) on NCRE and PEB controlling for baseline level (T0); while a one-way Anova was carried out for restoration.

In the case of NCRE, there was a significant main effect of time, $F(1, 991) = 255.46, p < .001, \omega^2 = .09$, indicating an overall decrease in NCRE from T1 to T2. There was also significant Time \times Condition interaction, $F(2, 991) = 11.14, p < .001, \omega^2 = .008$, suggesting that changes over time differed across conditions. Estimated marginal means indicated that NCRE decreased from T1 to T2 in the nature (2.99 to 2.65) and neutral conditions (2.92 to 2.75), whereas no reduction was observed in the urban condition (2.94 to 2.98). Post hoc comparisons with the Holm correction showed that NCRE levels were significantly lower in the nature condition compared to the urban condition ($p < .001$), and in the neutral condition compared to the urban condition ($p = .01$). No significant differences were found between the nature and neutral conditions ($p = .65$). Figure 4 (p. 34) shows how each group changed. All reported effects are adjusted for baseline levels (T0), which showed a significant association with NCRE, $F(1, 991) = 283.88, p < .001, \omega^2 = .12$. Overall, these results indicate that the reduction in NCRE over time was related to the intervention condition, with reductions observed in the nature and

neutral conditions but not in the urban condition. These findings partially support H1.1, since reductions in the nature condition were significantly larger compared to the urban condition, yet not when compared to the neutral stimuli.

In turn, reported restoration showed a significant main effect of condition, $F(2, 992) = 169.69, p < .001, \omega^2 = .25$. Descriptive statistics (Table 4, p. 30) indicated that participants in the nature condition reported the highest levels of restoration ($M = 3.50, SD = 0.90$), followed by the neutral condition ($M = 2.67, SD = 0.88$), and the urban condition ($M = 2.30, SD = 0.82$) (see Figure 4). Post hoc comparisons using Tukey's HSD revealed that all pairwise differences between conditions were statistically significant ($p < .001$). Specifically, restoration was significantly higher in the nature condition compared to both the urban and neutral conditions, and higher in the neutral condition compared to the urban condition. These findings support H1.2, indicating that exposure to nature is associated with higher levels of reported restoration compared to urban and neutral conditions.

As for PEB, there was a significant main effect of time, $F(1, 991) = 502.52, p < .001, \omega^2 = .20$, indicating an overall increase in PEB from T1 to T2. No significant main effect of condition was found, $F(2, 991) = 0.00, p = 1.00, \omega^2 = .00$, indicating that overall PEB levels did not differ between intervention conditions. The Time \times Condition interaction was not significant, $F(2, 991) = 0.14, p = .87, \omega^2 = .00$, suggesting that changes in PEB over time did not differ as a function of intervention condition. Estimated marginal means showed a small increase in PEB from T1 ($M = 5.76$) to T2 ($M = 5.82$) across all conditions (see Figure 4). All reported effects are adjusted for baseline levels (T0), which showed a significant association with PEB, $F(1, 991) = 524.99, p < .001, \omega^2 = .21$. Overall, these findings

do not support H.1.3, as increases in PEB were observed over time but were not associated with intervention condition.

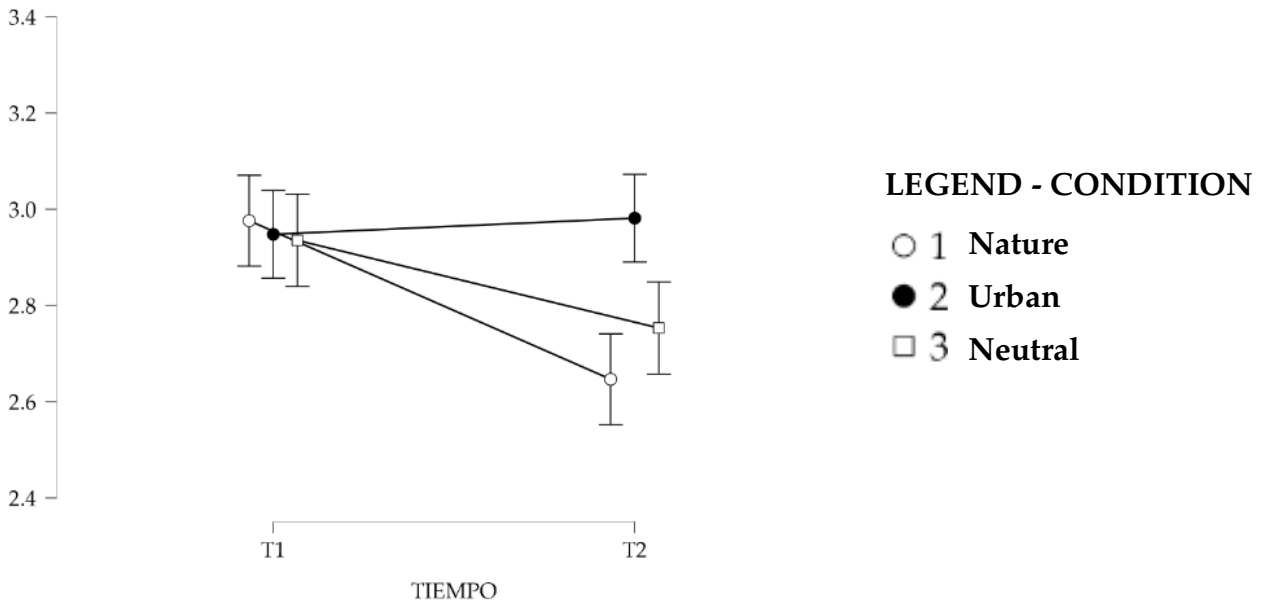
Table 5 presents the results of the analysis of variance for NCRE and PEB. Lastly, these findings were subject to sensitivity analysis by including device type (smartphone, computer, tablet) as a between-subjects factor. The results revealed no significant main effects or interactions involving device for NCRE, PEB, or restoration (all $p > .05$). These findings indicate that the type of device used to complete the procedure was not relevant.

Table 5

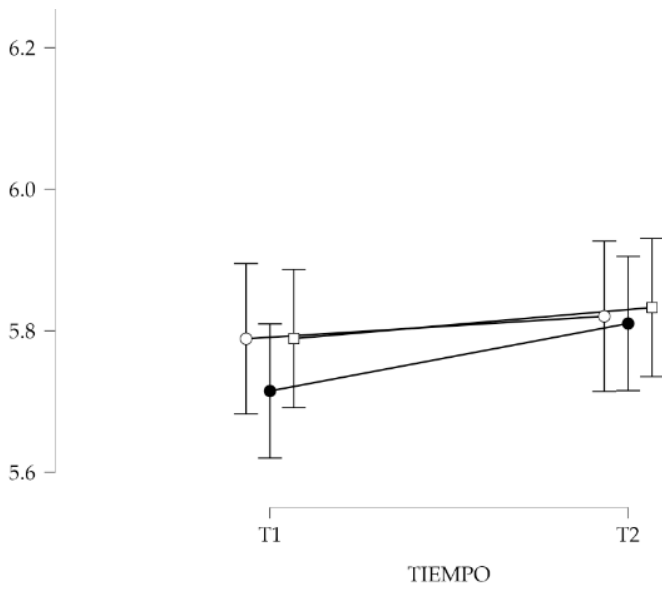
Analysis of Variance for NCRE and PEB after video exposure (T2)

Variable	NCRE			PEB		
	F	p	ω^2	F	p	ω^2
Within Subject						
Time	255.46	< .01	.11	502.52	< .01	0.20
Time x Group	11.14	< .01	< .01	0.14	0.87	0.00
Time x T0	327.08	< .01	0.14	503.09	< .01	0.20
Between Subjects						
T0 (Covariate)	283.88	< .01	.12	524.99	< .01	.21
Group	6.89	< .01	< .01	0.00	1.00	.00

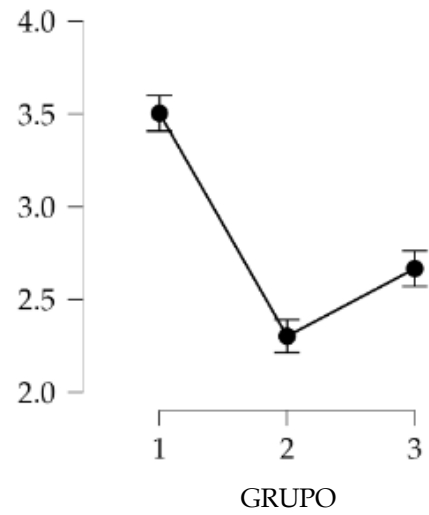
Note. Valid



4a. Negative Climate Related Emotions



4b. Pro-Environmental Behavior



4c. Reported Restoration

Figure 4 Descriptive Plots of Analysis of Variance for Negative Climate Related Emotions, Pro-Environmental Behavior and Reported Restoration

3.3 Mediation Analyses

Two SEM mediation analyses were conducted. The first analysis examined whether nature connection (NC; H.2.1.1) and reported restoration (RR; H.2.1.2) mediated the effect of digital exposure to nature on negative climate-related emotions (NCRE), controlling for T1 levels of NCRE and NC. The second analysis examined whether nature connection mediated the effect of digital exposure to nature on pro-environmental behavior (PEB; H.2.2), controlling for T1 levels of NCRE and NC. Both analyses were carried out independently for the nature vs. urban condition comparison and for the nature vs. neutral condition comparison.

3.3.1 Mediation for negative climate-related emotions

The first analysis examined whether nature connection (NC; H.2.1.1) and reported restoration (RR; H.2.1.2) mediated the effect of digital exposure to nature on negative climate-related emotions (NCRE). Table 6 (p. 37) shows the mediation effects and coefficients for the nature vs urban comparison, while Table 7 (p. 38) does likewise for the nature vs neutral comparison.

For the comparison between the nature and urban conditions, the indirect effect of condition on NCRE through RR was significant ($b = -0.36$, 95% CI $[-0.55, -0.20]$), indicating that RR mediated the relationship between exposure and NCRE, supporting H2.1.2. In contrast, the indirect effect through NC was not significant ($b \approx 0$, 95% CI $[-0.02, 0.02]$), indicating no evidence of mediation via NC and thus not supporting H2.1.1. The direct effect of condition on NCRE was not significant when both mediators were included in the model ($b = -0.06$, 95% CI $[-0.31, 0.20]$), whereas the total effect remained significant ($b = -0.42$, 95% CI $[-0.60, -0.22]$).

A comparable pattern emerged when contrasting the nature and neutral conditions. The indirect effect of condition on NCRE through RR was again

significant, although smaller in magnitude ($b = -0.11$, 95% CI $[-0.20, -0.01]$), while the indirect effect through NC remained non-significant ($b \approx 0$, 95% CI $[-0.02, 0.02]$). In this model, the direct effect of condition on NCRE was not significant ($b = -0.10$, 95% CI $[-0.30, 0.11]$), whereas the total effect was significant ($b = -0.20$, 95% CI $[-0.38, -0.02]$).

Reported restoration was negatively associated with NCRE in both comparisons, although the association was stronger in the nature vs. urban model ($b = -0.29$, $p < .01$) than in the nature vs. neutral model ($b = -0.12$, $p = .02$). This indicates that, across both models, higher levels of restoration were linked to lower levels of NCRE. Additionally, group condition significantly predicted reported restoration in both comparisons, with the nature condition eliciting higher restoration than both the urban condition ($b = 1.25$, $p < .01$) and the neutral condition ($b = 0.86$, $p < .01$). In contrast, NC was not significantly associated with NCRE in either the nature vs. urban model ($b = 0.05$, $p = .19$) or the nature vs. neutral model ($b = 0.009$, $p = .81$). Similarly, group condition did not significantly predict NC in either comparison, although the effect was close to significance in the nature vs. neutral model (nature vs. urban: $b = -0.005$, $p = .97$; nature vs. neutral: $b = 0.24$, $p = .07$).

Overall, these results partially support H2.1, indicating that the effect of digital nature exposure on NCRE operates through RR but not through NC. Importantly, this pattern was consistent across both condition comparisons, although the mediating effect of restoration was descriptively stronger when contrasting nature with urban stimuli than with neutral stimuli. Figure 5 (p. 39) shows the relationships among these variables for both condition comparisons.

Table 6

Mediation Effects and Coefficients for Nature Connection and Restoration on Negative Climate Related Emotions (Nature vs. Urban)

	Est.	SE	z	p	95% CI	
					Lower	Upper
<u>Path coefficients</u>						
RR → NCRE	-0.29	0.06	-4.45	< .01	-0.42	-0.16
NC → NCRE	0.05	0.04	1.32	.19	-0.02	0.12
Condition → RR	1.25	0.10	13.08	< .01	1.06	1.44
Condition → NC	-4.83×10 ⁻³	0.14	-0.03	.97	-0.28	0.27
<u>Direct effects</u>						
Condition → NCRE	-0.06	0.13	-0.44	.66	-0.31	0.20
<u>Indirect effects</u>						
Condition → RR → NCRE	-0.36	0.07	-4.96	< .01	-0.55	-0.20
Condition → NC → NCRE	-2.39×10 ⁻⁴	6.74×10 ⁻³	-0.04	.97	-0.02	0.02
<u>Total indirect effect</u>						
Condition → NCRE	-0.36	0.07	-4.96	< .01	-0.56	-0.20
<u>Total effect</u>						
Condition → NCRE	-0.42	0.10	-4.30	< .01	-0.60	-0.22

Note. Estimator is ML. Condition = digital exposure manipulation (1 = nature, 0 = comparison); NCRE = negative climate-related emotions (Ogunbode et al. (2023)); RR = reported restoration, (Moll et al. (2025)); NC = nature connection (INS; Schultz, 2001). Autoregressive and baseline-covariate paths were estimated but are omitted for clarity.

Table 7

Mediation Effects and Coefficients for Nature Connection and Restoration on Negative Climate Related Emotions (Nature vs. Neutral)

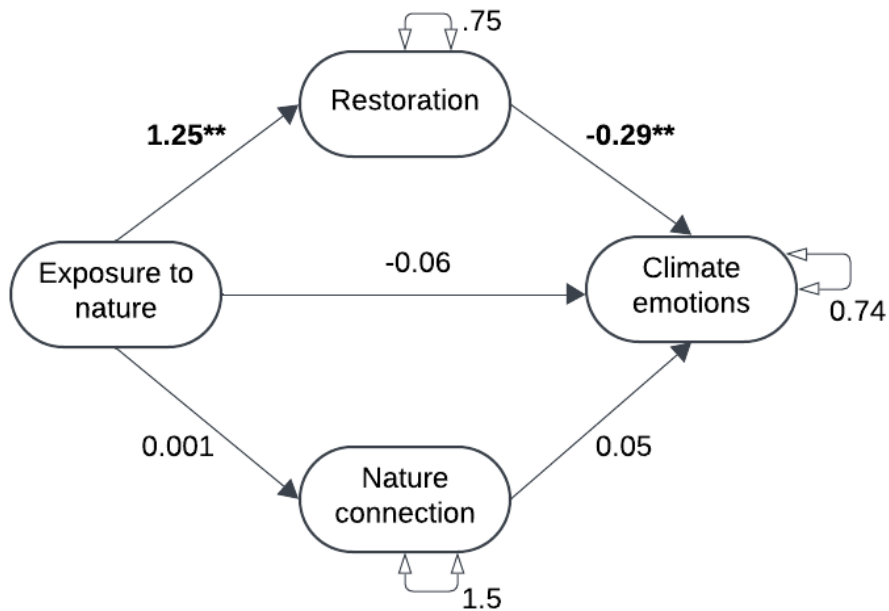
	Est.	SE	z	p	95% CI	
					Lower	Upper
<u>Path coefficients</u>						
RR → NCRE	-0.12	0.05	-2.30	.02	-0.23	-0.02
NC → NCRE	8.96×10 ⁻³	0.04	0.24	.81	-0.06	0.08
Condition → RR	0.86	0.09	9.11	< .01	0.68	1.05
Condition → NC	0.24	0.13	1.79	.07	-0.02	0.51
<u>Direct effects</u>						
Condition → NCRE	-0.10	0.10	-0.93	.35	-0.30	0.11
<u>Indirect effects</u>						
Condition → RR → NCRE	-0.11	0.05	-2.23	.03	-0.20	-0.01
Condition → NC → NCRE	2.16×10 ⁻³	9.09×10 ⁻³	0.24	.81	-0.02	0.02
<u>Total indirect effect</u>						
Condition → NCRE	-0.10	0.05	-2.18	.03	-0.20	-0.01
<u>Total effect</u>						
Condition → NCRE	-0.20	0.09	-2.13	.03	-0.38	-0.02

Note. Estimator is ML. Condition = digital exposure manipulation (1 = nature, 0 = comparison); NCRE = negative climate-related emotions (Ogunbode et al. (2023)); RR = reported restoration, measured with the scale used by Moll et al. (2025); NC = nature connection, measured with INS (Schultz, 2001). Autoregressive and baseline-covariate paths were estimated but are omitted for clarity.

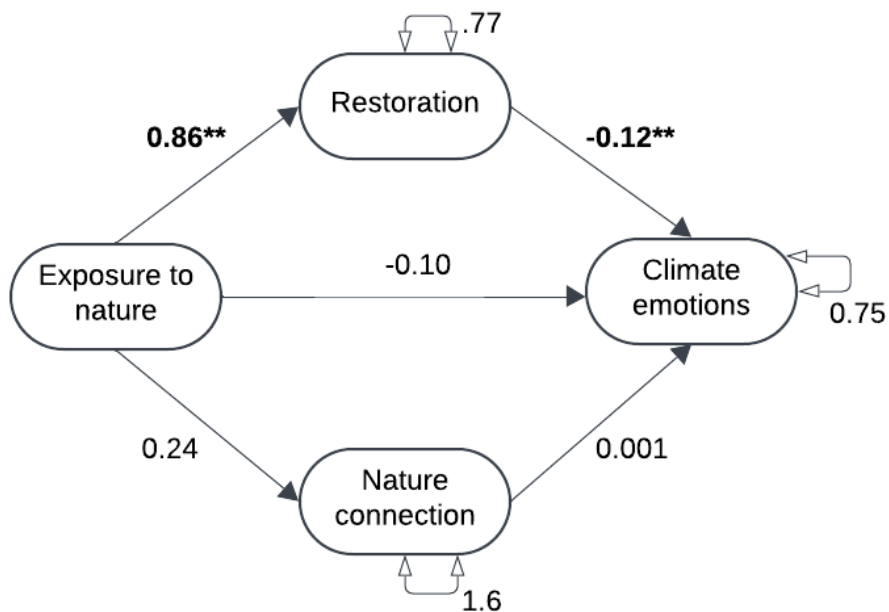
Figure 5

SEM Models for Indirect Effect of Exposure to Nature on Negative Climate Related Emotions via Nature Connection and Reported Restoration.

5A. Nature vs Urban Comparison



5B. Nature vs Neutral Comparison



Note. Path coefficients are unstandardized estimates from the structural equation model. Values on curved self-loops represent residual variances. Bold values and asterisks indicate statistical significance: * $p < .05$, ** $p < .01$. Coefficients displayed as 0.001 represent estimates with absolute values smaller than .01.

3.3.2 Mediation analysis for pro-environmental behavior

SEM mediation analyses were conducted to examine H2.2: whether NC mediated the effect of digital exposure to nature on PEB, controlling for T1 levels of NCRE and NC. Table 8 shows the mediation effects and coefficients for the nature vs urban comparison, while table 9 shows the same info for the nature vs neutral comparison. The indirect effect of condition on PEB through NC was not significant in both cases (urban: $b = -0.002$, 95% CI $[-0.10, 0.09]$; neutral: $b = 0.08$, 95% CI $[-0.009, 0.16]$), indicating no evidence of mediation. The same applied in the case of the direct effect of condition on PEB, which was also not significant in both cases (urban: $b = -0.12$, 95% CI $[-0.32, 0.07]$; neutral: $b = -0.11$, 95% CI $[-0.30, 0.09]$). Lastly, the total effect was also non-significant (urban: $b = -0.12$, 95% CI $[-0.33, 0.09]$; neutral: $b = -0.03$, 95% CI $[-0.24, 0.18]$). Additionally, in both comparisons NC was positively associated with PEB (urban: $b = 0.33$, $p < .001$; neutral: $b = 0.31$, $p < .001$); the type of content in the video did not significantly predict NC (urban: $b = -0.005$, $p = .97$; neutral: $b = 0.24$, $p = .07$). These results do not support H2.2, as no indirect effect of digital nature exposure on PEB through NC was observed. However, the role of NC as a predictor of PEB was corroborated. Notably, this null result reflected different patterns across the two contrasts: in the urban comparison, condition did not shift NC; in the neutral comparison, NC moved marginally but the indirect effect did not reach significance. Figure 6 in page 42 shows the relationships among these variables.

Table 8

Mediation Effects and Coefficients for Nature Connection on Pro-environmental Behavior (Nature vs. Urban)

	Est.	SE	z	p	95% CI	
					Lower	Upper
<u>Path coefficients</u>						
NC → PEB	0.33	0.06	5.88	< .01	0.23	0.45
Condition → NC	-4.69×10 ⁻³	0.14	-0.03	.97	-0.27	0.27
<u>Direct effects</u>						
Condition → PEB	-0.12	0.10	-1.19	.23	-0.32	0.07
<u>Indirect effects</u>						
Condition → NC → PEB	-1.55×10 ⁻³	0.04	-0.03	.97	-0.10	0.09
<u>Total effect</u>						
Condition → PEB	-0.12	0.11	-1.10	.27	-0.33	0.09

Note. Estimator is ML. Condition = digital exposure manipulation (1 = nature, 0 = comparison); PEB = pro-environmental behavior, measured thru PI scale (Kotyza et al., 2024); NC = nature connection, measured with INS scale (Schultz, 2001). Autoregressive and baseline-covariate paths were estimated but are omitted for clarity.

Table 9

Mediation Effects and Coefficients for Nature Connection on Pro-environmental Behavior (Nature vs. Neutral)

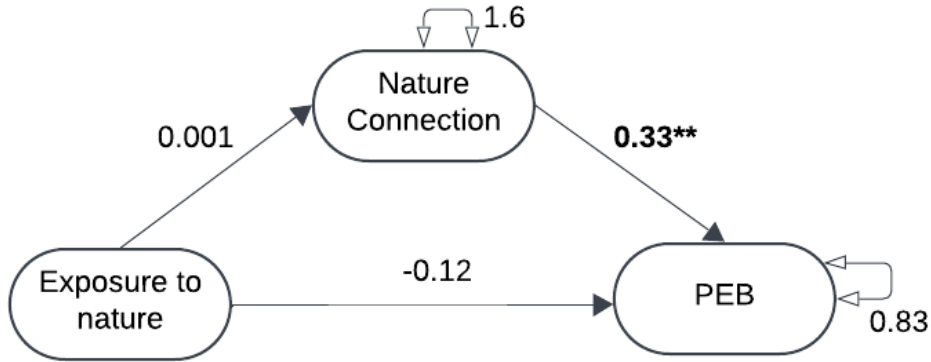
	Est.	SE	z	p	95% CI	
					Lower	Upper
<u>Path coefficients</u>						
NC → PEB	0.31	0.04	7.99	< .01	0.24	0.39
Condition → NC	0.24	0.13	1.79	.07	-0.02	0.51
<u>Direct effects</u>						
Condition → PEB	-0.11	0.10	-1.09	.28	-0.30	0.09
<u>Indirect effects</u>						
Condition → NC → PEB	0.08	0.04	1.75	.08	-9.19×10 ⁻³	0.16
<u>Total effect</u>						
Condition → PEB	-0.03	0.11	-0.30	.77	-0.24	0.18

Note. Estimator is ML. Condition = digital exposure manipulation (1 = nature, 0 = comparison); PEB = pro-environmental behavior, measured thru PI scale (Kotyza et al., 2024); NC = nature connection, measured with INS scale (Schultz, 2001). Autoregressive and baseline-covariate paths were estimated but are omitted for clarity.

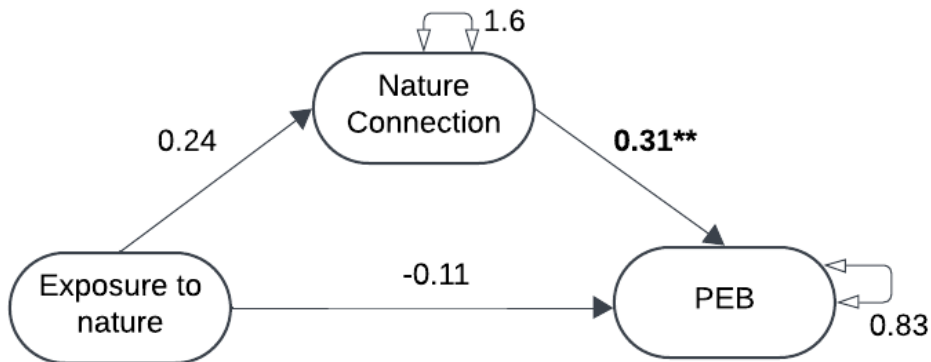
Figure 6

SEM Models for Indirect Effect of Exposure to Nature on Pro-environmental Behavior via Nature Connection

6A. Nature vs Urban Comparison



6B. Nature vs Neutral Comparison



Note. Path coefficients are unstandardized estimates from the structural equation model. Values on curved self-loops represent residual variances. Bold values and asterisks indicate statistical significance: * $p < .05$, ** $p < .01$. Coefficients displayed as 0.001 represent estimates with absolute values smaller than .01.

4. DISCUSSION

Climate change is an urgent challenge. To tackle it, negative climate related emotions [NCRE] need to be within an adaptive range that enables pro-environmental behavior [PEB] rather than hampering it. Contact with nature, especially when compared to exposure to urban environments, has been a central feature of nature-based solutions that seek to promote the reduction of NCRE and increase PEB. Additionally, recent technological developments have made it possible to digitally access the benefits of nature contact. Past literature has highlighted the role of nature connection [NC] and psychological restoration as process variables in the relationships between exposure to nature, NCRE and PEB.

The present study sought to add information to several open themes within this web of relationships. Firstly, whether digital exposure to nature had more restorative effects, decreased NCRE and increased PEB when compared to exposure to urban environments. Secondly, whether NC acts as a process variable between nature exposure and NCRE or PEB. A 2x3 procedure was implemented in order to explore these objectives, with digital exposure to urban and neutral stimuli used as control conditions. After exposure to these stimuli, our findings show that the nature condition resulted in a larger decrease of NCRE than the urban condition but similar to the neutral condition, partially supporting H.1.1. Also, the nature condition had a larger restorative effect than both the urban and the neutral conditions, supporting H.1.2. None of the conditions had a relevant impact on PEB, which dismissed H.1.3. Additionally, H.2.1.2 received support as psychological restoration mediated the impact of the nature condition on NCRE. Lastly, NC did not mediate the impact of the nature condition on neither NCRE or PEB, dismissing H.2.1.1 and H.2.2 respectively. NC did predict

PEB in this mediation model and presented a trend towards significant change due to exposure to nature in the comparison with the neutral model. The most relevant implications and limitations of these findings are presented in the following subsections.

4.1 Impact of digital exposure to nature on negative climate related emotions and pro-environmental behavior through differential restorative qualities of nature

Firstly, the direct effects of exposure to digital nature were consistent with previous research showing that exposure to nature reduced NCRE to a greater extent than exposure to urban environments (Mahamane et al., 2020; Pasca et al., 2022; Spano et al., 2023). However, contrary to previous findings (Moll et al., 2025; Yang et al., 2021), the neutral condition did not differ significantly from the nature condition in terms of reducing NCRE.

One likely reason behind these results is that the neutral condition in the present study was adjusted following the pilot study: several participants complained that the white noise was too intense and was thus lowered for the actual experiment. It seems like the white noise then became too pleasant, increasing the restorative effects of the neutral condition (Awada et al., 2022; Ding et al., 2025; Herweg & Bunzeck, 2015). However, the resulting staggered degree of reduction in NCRE and in restoration levels allows to put forward some interpretations.

Firstly, it could be argued that all conditions shared some restorative features. One of these features could be the relief from leaving the experimental task of answering questionnaires (Schumann et al., 2022). Likewise, it seems reasonable to speculate that each condition had its own unique restorative features: urban (Jeon et al., 2021) and neutral mentioned above. Nonetheless,

taken together the results point to the existence of differential restorative qualities within the nature condition. Additionally, given that restoration significantly mediated the effect of condition (in both nature vs urban and nature vs neutral) on negative climate emotions during digital exposure, the presence of these differential factors was supported. The importance of such factors is further emphasized by the finding that once restoration was modeled as a mediator, the direct effect of exposure to nature on climate emotions lost statistical significance. This indicates full mediation by restoration.

The differential restorative effects observed across conditions can be interpreted with the Stress Reduction Theory (Ulrich, 1983; Ulrich et al., 1991), which posits that natural environments trigger an affective response of recovery rooted in our evolutionary association of nature with safety and resource availability. This emotional pathway is particularly relevant for the present study, given that the dependent variable was negative climate-related emotions. Unlike the urban and neutral conditions, the nature stimuli likely combined visual and auditory cues that elicit positive affective appraisals and downregulate negative emotional arousal (Alvarsson et al., 2010; Pasca et al., 2021). This affective regulation may have been especially impactful for participants who had previously been exposed to the eco-anxiety video in ITV1, for whom the nature condition offered not only a generic break but an emotionally congruent recovery from climate-related distress. In this sense, the restorative qualities of nature appear to extend beyond mere attentional replenishment (Kaplan & Kaplan, 1989) to encompass an emotional restoration that is particularly suited to coping with climate-related negative emotions.

The finding of these differential restorative qualities and their mediating role has important implications with regards to the implementation of nature

based solutions that aim to promote adaptive coping. One necessary condition for such coping to take place is for negative emotions to be present to a degree that mobilizes without crippling (Hogg et al., 2024; Pihkala, 2022b; Stanley et al., 2021). Hence, the findings in the current paper support the use of nature exposure to promote adaptive coping by lowering NCRE. The results mentioned above also extend previous findings in two ways. Firstly, it supports the feasibility of obtaining these benefits through the use of digital nature (Fan & Baharum, 2024a). Secondly, they suggest that, despite the existing screen size difference between a smartphone and a tablet or laptop, the type of device does not influence results. This is in line with previous findings (Soliman et al., 2017). Such finding is worth noting given that smartphones are cheaper and easier to transport, thus making it possible to facilitate contact with digital nature in a wider array of settings and populations.

4.2 The process role of nature connection on negative climate related emotions and pro-environmental behavior

The role of nature connection as a mediator in the effect of digital exposure on both NCRE and PEB was not supported. These results could be explained by not having properly target the NC concept on two levels. The first level is to not have manipulated NC adequately, which Mackay and Schmitt (2019) have previously pointed out as one of the shortcomings of studies that seek to influence NC in experimental settings (Klein & Hilbig, 2018; Soliman et al., 2017; Zelenski et al., 2015a). In this sense, it's probable that the video duration may not have been long enough. Additionally, another level in which the experiment may not have properly targeted NC is by using the INS to measure it. INS is a measure designed with the trait paradigm in mind. Instead, a more appropriate measure would have been the recent State of Interdependence with Nature Scale (Hanley

et al., 2022), which has been specifically designed to measure momentary fluctuations of NC. Regardless of the overall lack of support for the mediating role of NC, a look at the individual paths of the models offers further nuance.

Most relevant to the open debate on the dual trait-state nature of NC, the *a* path (from exposure to nature to NC) in the nature vs neutral condition had a small effect size that approached significance ($B=0.24, p=.07$), indicating that NC did shift and thus keeping the door open to the state nature of NC despite the shortcomings in targeting the construct. With regards to the nature of the relationship between NC and PEB, its well established existence (Guazzini et al., 2025) was replicated in the significant *b* paths (from NC to PEB) for both conditions. As for a possible causal role of NC on PEB, the direction of the mediation analysis did not allow to test it. However, NC did predict PEB on the *b* path (from NC to PEB) for both conditions, replicating previous findings where the INS predicted PEB (Olivos & Aragónés, 2011). Taken together, these results suggest that NC might have a dual trait-state nature, and that it is indeed relevant as a process variable for PEB given its ability to predict it. Hence, our study underscores that the current limitation is the experimental manipulation of NC, while its effects on PEB deserve further study.

4.3 Limitations and future directions

There are several limitations to account for. Firstly, methodological limitations were one of the major hindrances of the study. The INS has moderate quality and none of questionnaires used to measure NCRE, RR or PEB have been validated to a Spanish sample, and the RR and PEB instruments have not undergone formal psychometric validation in their adapted versions. The team behind the present paper is currently in the process of validating the NCRE with a Spanish sample, and other future studies could validate the rest of the questionnaires to improve

the methodological quality of the field. Additionally, using only questionnaires left the present study open to self-report bias. Future studies that include physiological or behavioral measurements would be an improvement. This is especially relevant in the case of restoration (Alvarsson et al., 2010; Mahamane et al., 2020) and PEB, since the current study used a pro-environmental intentions measure, which have shown a high correlation with PEB but a tendency to overestimate it (Mackay & Schmitt, 2019).

In second place, the study also had a sampling limitation that affects its generalizability. The current paper employed a sample of university students, and university students NC levels have demonstrated a significant difference versus non-university samples in the past (Guazzini et al., 2025; Mackay & Schmitt, 2019a). Additionally, the current sample lives in a major metropolitan area. Future studies could investigate samples of the general population and of people living in rural areas.

A third area where the current paper has room for improvement is with regards to the examination of the web of relationships among the variables of the study. Firstly, the scope of the present study did not include a network analysis, which would have allowed the relationships among all variables to be explored together at the same time. Such network analysis is a feature of recent studies in the field (Ágoston et al., 2024). Furthermore, the mediation analysis modeled post-intervention scores while adjusting for baseline, rather than modeling change directly. Approaches that estimate the correlations between within-person changes in mediator and outcome would provide a more direct test of the proposed mechanism. Additionally, several concrete relationships remain underexplored. First, the role of NCRE as mediator of the impact of nature exposure on PEB (Kratz & McEwan, 2025). To be more precise, although the

current paper succeeded in avoiding the metonymy between negative climate related emotions and eco-anxiety, it did not differentiate the effects that discrete eco-emotions seem to have on the route between nature exposure and pro-environmental behavior (Ágoston et al., 2024; Corvello et al., 2025). In particular, future studies could examine the role of eco-anger (Stanley et al., 2021) and eco-grief (Pihkala, 2022a). Second, the role of restoration as a mediator of exposure to nature on PEB (Whitburn et al., 2019) is also in need of further study.

Lastly, given that the current stimuli were a composite of the images from previous studies plus the addition of sounds, it is not possible to directly compare the results in this study with previous ones (Moll et al., 2025; Yang et al., 2021). Also, no effort was made in the present study to determine how much weight the images and the audio or the combination of both had over the effects of the intervention. Future studies could isolate these variables in control groups to better understand their effect, especially in terms of their restorative power (Spano et al., 2023). In a similar vein, although the present study found no difference depending on the device used, more research is needed to test if the smaller screen size of smartphones is actually irrelevant.

4.4 Conclusion

Nature based solutions have contact with nature as one of their hallmarks. The present study reinforced the existence of differential restorative qualities within nature stimuli, as well as the effect that these factors have in lowering negative emotions related to the climate. Given that having such emotions within an adaptive range is necessary to engage in adequate coping mechanisms such as pro-environmental behaviors (Hogg et al., 2024; Pihkala, 2022a; Stanley et al., 2021), the present findings support policies that facilitate access to nature. It also reinforces the validity of digital exposure as a means of contacting nature (Fan &

Baharum, 2024). However, the present study did not demonstrate a direct relationship between exposure to nature and reported pro-environmental behavior. It also did not add evidence supporting a mediating role for nature connection in either lowering negative climate related emotions or increasing pro-environmental behavior, although it reconfirmed that nature connection predicts reported pro-environmental behavior (Whitburn et al., 2020). Nonetheless, the findings presented support the use of digital exposure to nature as a means of tapping into the restorative benefits of contact with nature. Such benefits have consequences not just in the wellbeing of people but also in the wellbeing of the planet that is our home.

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Annexes

Annex 1: Informed Consent

¡Hola! Somos el equipo de investigación formado por Silvia Collado, Rocío Rodríguez Rey y Marta Carballo Losada, de la Universidad Pontificia Comillas y la Universidad de Zaragoza. Estamos haciendo un estudio sobre la relación entre el cambio climático y la salud mental, para lo que necesitamos tu ayuda. Se trata de contestar a una serie de preguntas breves y visualizar dos vídeos.

Tus respuestas serán anónimas y nunca se asociarán a tu identidad. Además, no hay respuestas correctas ni incorrectas. Solo las componentes del equipo de investigación tendrán acceso a las respuestas, que serán utilizadas con fines de investigación y tratadas de acuerdo a la normativa vigente de protección de datos. Puedes abandonar el estudio cuando lo desees, sin dar explicación y sin que ello tenga consecuencias. Si tienes cualquier pregunta relacionada con el estudio o si deseas contactar con nosotras, puedes hacerlo a través de la siguiente dirección de correo: mcarballo@comillas.edu

La participación te llevará aproximadamente 20 minutos. Al aceptar participar en el estudio de manera voluntaria, confirmas ser mayor de 14 años y haber leído y comprendido esta información. En la medida de lo posible, te agradeceríamos que accedas al cuestionario y veas los vídeos desde un ordenador o tablet para asegurar su correcta visualización.

¡Muchísimas gracias por tu ayuda y tu tiempo!

Por favor, si aceptas participar, marca SÍ en el siguiente apartado.

Consentimiento

Señala si das tu consentimiento para participar en el estudio:

- SÍ
- NO

Annex 2: Negative Climate Related Emotions Questionnaire

Por favor, céntrate en tus pensamientos y emociones con relación al cambio climático. Indica en qué medida sientes las siguientes emociones en relación con el cambio climático en este momento.

	1	2	3	4	5
	Para nada	Un poco	Moderadamente	Mucho	Extremadamente
1. Calmado/a/e (r)					
2. Tenso/a/e					
3. Relajado/a/e (r)					
4. Ansioso/a/e					
5. Tranquilo/a/e (r)					
6. Preocupado/a/e					
7. Aterrorizado/a/e					

Annex 3: Pro-environmental Intentions Questionnaire

Escala 'proenvironmental intentions' (PI; adaptada por Kotyza et al., 2024)

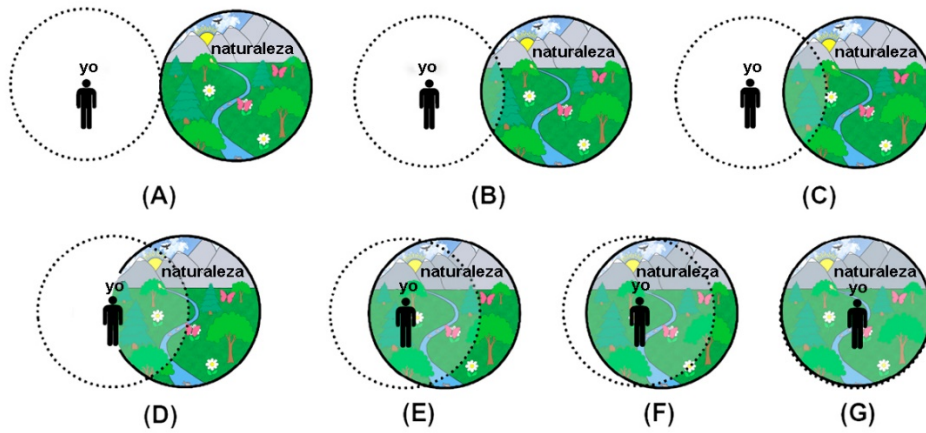
Señala en qué medida estás de acuerdo o en desacuerdo con las siguientes

afirmaciones:

	1	2	3	4	5	6	7
	Totalmente en desacuerdo	En desacuerdo	Ligeramente en desacuerdo	Ni de acuerdo ni en desacuerdo	Ligeramente de acuerdo	De acuerdo	Totalmente de acuerdo
1. Tengo intención de proteger el medioambiente. <i>[I plan to protect the environment.]</i>							
2. Estoy dispuesto/a/e a hacer algo para proteger el medioambiente. <i>[I am willing to do something to protect the environment.]</i>							
3. Haré un esfuerzo para proteger el medioambiente. <i>[I will make an effort to protect the environment.]</i>							

Anexo 4 – Inclusion of Nature in Self

Señala qué imagen representa mejor tu relación con la naturaleza, ¿cómo de cerca y conectado/a/e te sientes con la naturaleza? Siendo A: muy poco conectado/a/e y G: muy conectado/a/e.



Annex 5 - Reported Restoration

Reported restoration (Staats et al., 2003; Moll et al. 2025)

Señala en qué medida estás de acuerdo o en desacuerdo con las siguientes afirmaciones:

	1	2	3	4	5
	Totalmente en desacuerdo	En desacuerdo	No lo sé	De acuerdo	Totalmente de acuerdo
1. Me siento libre y relajado/a/e después de pasar tiempo observando este vídeo					
2. Puedo pensar de manera más clara después de pasar tiempo observando este vídeo					
3. Me siento lleno/a/e de energía después de observar este vídeo					
4. Me siento en calma después de pasar tiempo observando este vídeo					

Annex 6 – Uso de Inteligencia Artificial

DECLARACIÓN USO DE HERRAMIENTAS DE INTELIGENCIA ARTIFICIAL GENERATIVA

Título del trabajo: Impact of digital exposure to nature on negative climate related emotions and pro-environmental behavior: the role of nature connection and restoration

Autor/a: Luka Charrabe

DNI/Alumno: 05459798N

Nombre del Director/a de TFM: Dr. Rocío Rodríguez-Rey

Nombre del Máster: Máster en Psicología General Sanitaria

Coordinador/a de TFM: Pablo Fernandez Cancer

Mediante la presente, declaro que en la elaboración del trabajo arriba indicado he utilizado herramientas de Inteligencia Artificial Generativa en las siguientes fases (marcar y describir):

Búsqueda y localización de bibliografía: [indicar herramienta(s) y breve descripción del uso y prompts].

Elicit, pago la suscripción pro. La uso tanto para generacion de informes sobre un tema:

Prompt: Primers, systematic reviews and meta-analysis of the state of Nature based Solutions in the field of psychology. I want a general view, then focus on randomized controlled trials using Nature based solutions that used exposure to nature, both in real life and digital exposure, and have as outcome the reduction in negative climate related emotions, including eco-anxiety. Also interested in studies that use nature connectedness as a moderator / mediator

Como también para búsqueda de bibliografía concreta:

Prompt: find me papers that have used 'proenvironmental intentions' scale used by Kotiza 2024

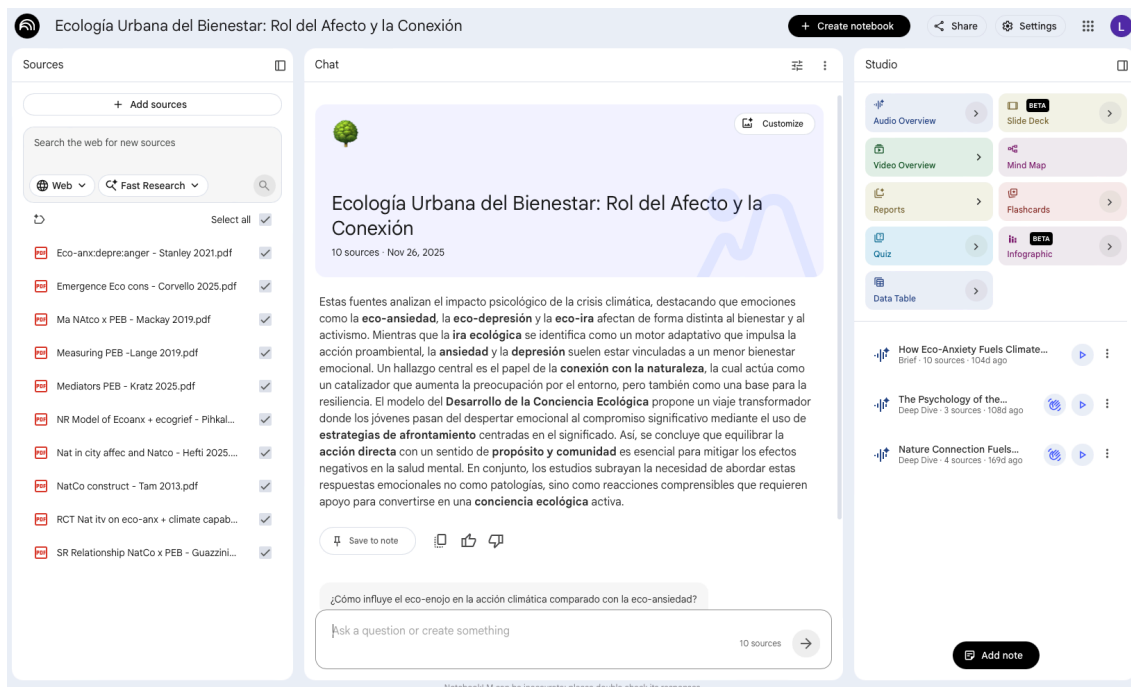
La captura a continuación muestra las búsquedas desde noviembre:

Name	Type	Last modified
<input type="checkbox"/> psychological restorative effects of white noise	Find papers	10:31am today
<input checked="" type="checkbox"/> Nature Connectedness: Trait and State Dimensions	Agent session	4:02pm May 10
<input type="checkbox"/> <input checked="" type="checkbox"/> Methods PI-PEB, INS	Agent session	10:01am Apr 20
<input checked="" type="checkbox"/> Effects of Environmental Interventions on NCRE, PEB, and RR	Agent session	7:14am Apr 13
<input checked="" type="checkbox"/> Managing Anger: Therapeutic Approaches for Adult Males	Agent session	10:31am Apr 6
<input type="checkbox"/> Effective psychological treatment for anger issues in adult males in western countries who have outburst with their romantic par...	Find papers	9:27pm Apr 5
<input checked="" type="checkbox"/> Methods Reported Restoration	Agent session	7:45pm Apr 3
<input type="checkbox"/> find me papers that have used 'proenvironmental intentions' scale used by Kotiza 2024	Find papers	5:51pm Apr 3
<input type="checkbox"/> role of nature connection (aka connection to nature, nature connectedness) in mediating the impact of exposure to nature on re...	Find papers	9:37am Mar 23
<input type="checkbox"/> role of nature connection (aka connection to nature, nature connectedness) in mediating reported restoration and pro environm...	Find papers	9:35am Mar 23
<input type="checkbox"/> studies that have used the sceptisim about climate change developed by Tobler 2012	Find papers	12:13pm Feb 25
<input type="checkbox"/> Nature connection in adults systematic and narrative reviews, and meta-analysis of the relationship between nature connection ...	Find papers	4:48pm Feb 1
<input type="checkbox"/> Primer on Proenvironmental Behavior in psychology	Find papers	11:16am Jan 31
<input type="checkbox"/> Studies and experiments of a any kind (descriptive, correlation, act) that have used the negative climate related emotions quest...	Find papers	11:39am Jan 29
<input type="checkbox"/> Digital Nature Exposure and Pro-Environmental Behavior	Report	9:56am Jan 29
<input type="checkbox"/> Im doing research on negative climate related emotions in adults. I want to understand the concept of pro environmental behavi...	Find papers	12:56pm Jan 26
<input type="checkbox"/> Best practices on emotion focused therapy for chair work with young adults of the evitative attachment type who interrupt emot...	Find papers	4:56pm Dec 1
<input type="checkbox"/> How does built environment in psychiatric and psychological intervention in hospitalization units and domiciliary interventions in...	Find papers	4:38pm Nov 29
<input type="checkbox"/> Nature-Based Solutions in Psychology: A Systematic Review of RCTs on Climate-Related Emotions	Report	1:17pm Nov 26
<input type="checkbox"/> studies that have used the ICE Inventory of climate emotions by Marczak as one of their tools	Find papers	11:45am Nov 21
<input type="checkbox"/> RCT where the intervention was exposure to nature or digital nature and measured as an outcome reported restoration from neg...	Find papers	2:49pm Nov 16
<input type="checkbox"/> RCT that measured reported restoration from negative emotions related to climate change after exposure to nature or digital na...	Find papers	2:45pm Nov 16

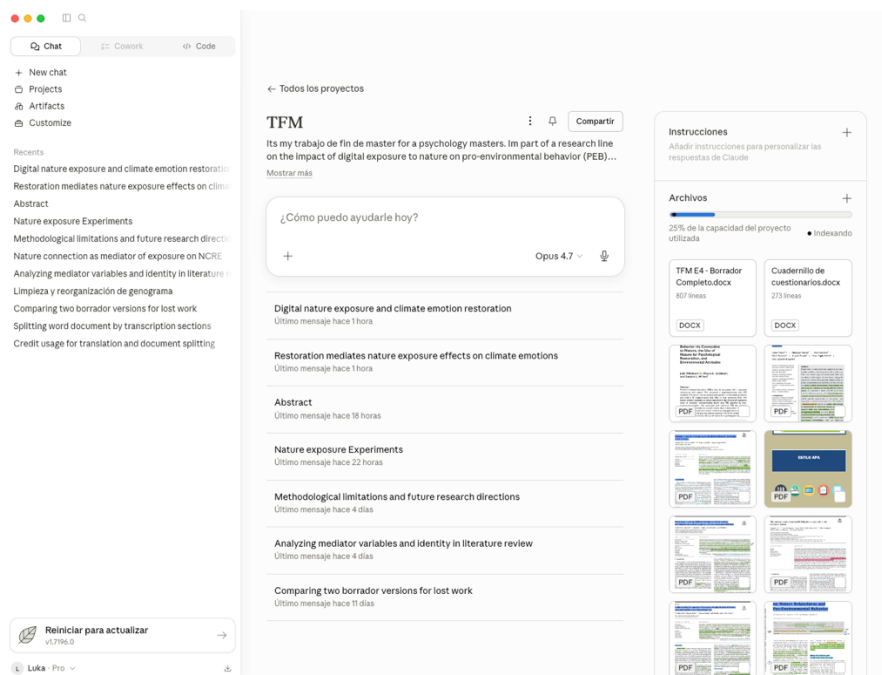
Resumen/ayuda para comprensión de textos: [indicar herramienta(s) y breve descripción del uso y prompts].

Los informes que da Elicit son una síntesis, y puedes hablar con un agente sobre el informe. El historial no guarda estas conversaciones.

También uso Notebook LM para generar podcast sobre temáticas concretas. Escucho estos podcast antes de leerme los artículos, me hace una especie de priming que ayuda a comprenderlos mejor y mas rápido. La captura a continuación muestra uno de los cuadernos que use para el tfm (se ven tres podcast al lado derecho, y los artículos que subi a la izquierda)



También he usado Chatgpt, y mas recientemente Claude, ambas con la subscripcion pro, para consultar dudas sobre artículos, pero principalmente para que lo ponga en conexión con mi trabajo. En ambas IAs tengo un proyecto creado, con el documento Word, archivos relevantes de diseño y cuestionarios, guía Apa, y papers mas relevantes. La captura a continuación muestra el proyecto para Claude:



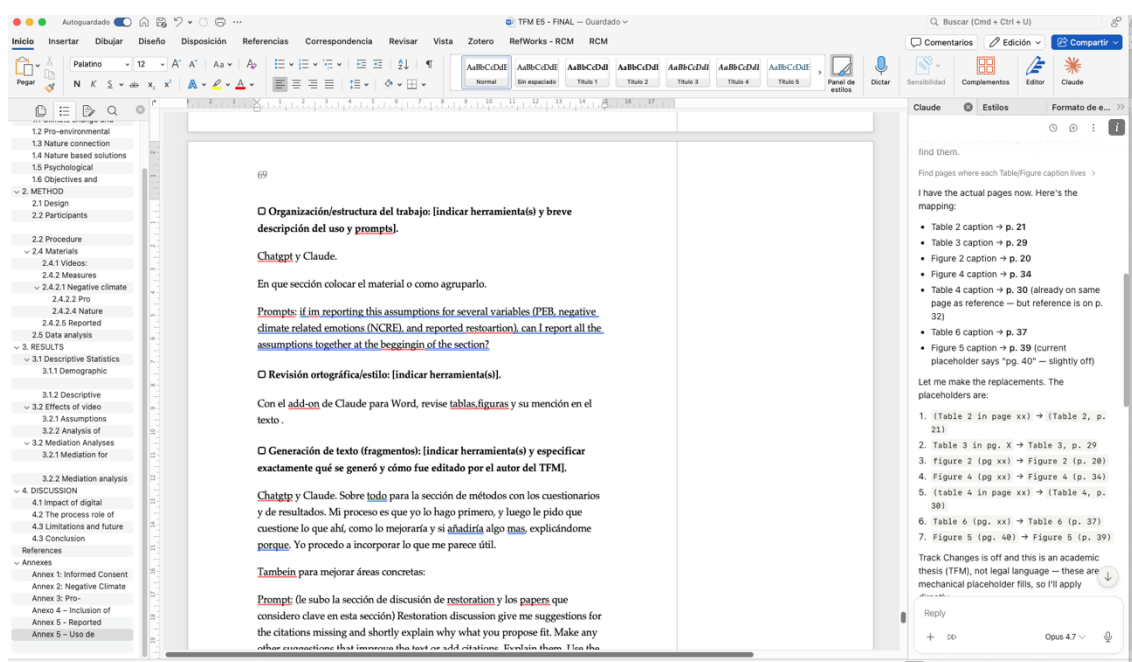
□ **Organización/estructura del trabajo:** [indicar herramienta(s) y breve descripción del uso y prompts].

Chatgpt y Claude. En que sección colocar el material o como agruparlo.

Prompts: if im reporting this assumptions for several variables (PEB, negative climate related emotions (NCRE), and reported restoartion), can I report all the assumptions together at the begginin of the section?

□ **Revisión ortográfica/estilo:** [indicar herramienta(s)].

Con el add-on de Claude para Word, revise tablas,figuras y su mención:



Ademas, le meti capturas de pantalla de mi resultados y de tablas de artículos de referencia y le pedi que me hiciese esas tablas, retocándolas yo posteriormente. Tambien Al acabar el documento, se lo meti a Claude y le pedi:

Prompt: This is the final document. Review the entire text in search of gramatical mistakes, unproperly cited figures and tables, repetiton of words or sentences, akward phrasing and any other mistakes that affect how the text is presented. Then, make a list with the needed changes, indicating error to fix and page number. Do not edit the text yourself.

□ **Generación de texto (fragmentos): [indicar herramienta(s) y especificar exactamente qué se generó y cómo fue editado por el autor del TFM].**

Chatgtp y Claude. Sobre todo para la sección de métodos con los instrumentos y de resultados. Mi proceso es que yo lo hago primero, y luego le pido que cuestione lo que ahí, como lo mejoraría y si añadiría algo mas, explicándome por qué. Yo procedo a incorporar lo que me parece útil.

Tambien para mejorar áreas concretas:

Prompt: (le subo la sección de discusión de restoration y los papers que considero clave en esta sección) Restoration discussion give me suggestions for the citations missing and shortly explain why what you propose fit. Make any other suggestions that improve the text or add citations. Explain them. Use the papers I have uploaded to this chat and to the project as a whole- Do not edit the text directly.

Añado captura de lo que me da:

Gap 2: "One of these features could be the relief from leaving the experimental task of answering questionnaires (Schumann et al., 2022)"

This citation is well placed but could be strengthened. Schumann et al. (2022) is exactly the right reference here — they explicitly define rest breaks as "temporal interruptions of an activity, serving the purpose of regenerating mental functions" and discuss how *any* change in activity can produce restoration. You might also add:

- **Helton & Russell (2015)** — cited within Schumann et al. (2022). They demonstrated that "rest is best" but also that any change in task produces some restoration relative to continuous activity, which directly supports your point that the mere break from questionnaire-answering is itself restorative.

Why this fits: It directly substantiates the claim that breaking from a sustained-attention/cognitive task (questionnaires) produces measurable restoration, regardless of what fills the break.

Gap 3: "each condition had its own unique restorative features: urban (Jeon et al., 2021) and neutral (add citations)"

For urban — Jeon et al. (2021) is excellent. They explicitly identify potential restorative effects of urban soundscapes and found that urban environments with preferred soundscapes have restorative potential. You could complement with:

- **Karmanov & Hamel (2008)** — cited within Jeon et al. (2021), showing interesting/attractive urban environments can reduce stress and improve mood.
- **Stigsdotter et al. (2017)** — cited within Jeon et al. (2021), showing urban environments can trigger physiological restoration relative to office/minibus environments.

For neutral — suggested citations:

- **Alvarsson, Wiens, & Nilsson (2010)** — Particularly relevant. Their "ambient noise" condition (40 dB quiet backyard) was compared with nature sounds and noise. While nature sound produced fastest sympathetic recovery, the ambient/low conditions still showed substantial recovery, suggesting that low-level, non-aversive sound conditions also have restorative qualities.

Escribe un mensaje...



Opus 4.7

□ Otros (especificar):

Chatgpt como guía para hacer e interpretar los análisis estadísticos en Jasp.

Prompts: (inserto captura del menú de jasp para mediación) He creado una variable nueva que es $g1+g4$. en ella, el valor 1 indica los participantes que vieron el video de naturaleza en t2, el valor 2 son el resto de grupos. QUIero hacer un analisis de mediacion de la conexion de la naturaleza entre la exposicion a la naturaleza y la conducta pro ambiental. Que tengo que poner en cada cajon del analisis de mediacion'

Prompt: Explain to me every statistic in this analysis, what it measures, the kinds of scores possible and then the specific results.

Tambien lo he usado para comprender mis análisis:

TFM - Eco-anxiety

Share



Rocío es mi tutora y la respuesta a su pregunta creo que es que nosotros, con este análisis de mediación, no estamos calculando el cambio de T1, o sea, la correlación del cambio de T1 a T2 en esas variables, sino que el análisis de mediación coge los valores de T2 y compara el valor del T2 de MCRE con NC y con restoration y con climate emotions, como se ve en la tabla que te paso. Entonces, el meter los valores del T1 sirve para añadir un elemento de control. ¿Qué más añadirías a esta explicación?



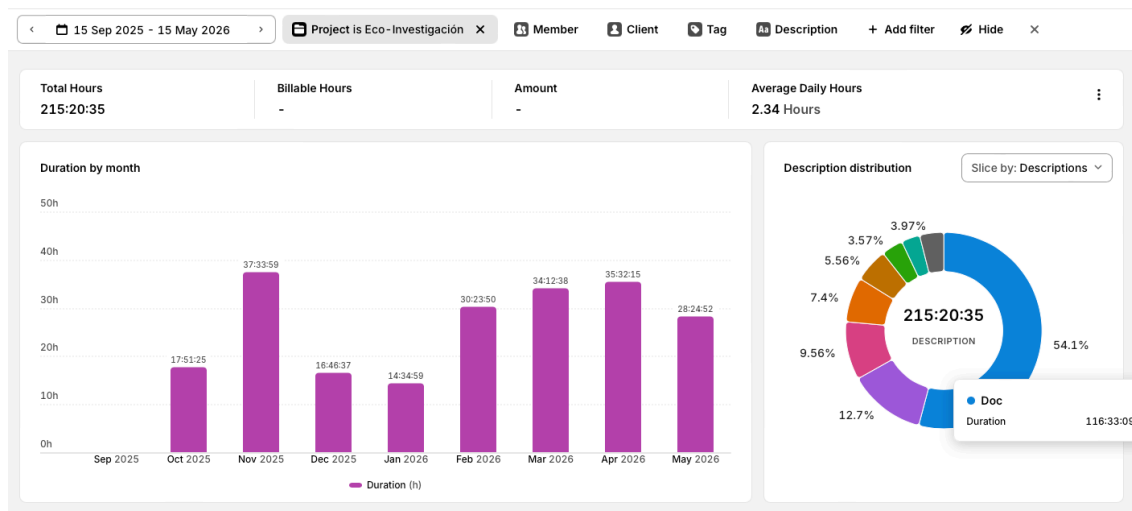
Tu explicación va bien encaminada, pero ahora mismo se queda un poco **descriptiva** y le falta cerrar tres ideas clave que Rocío probablemente está echando en falta:

1. qué efecto estás estimando exactamente,
2. por qué T1 se mete como covariable,
3. qué implica esto para la interpretación (cambio vs niveles).

Te lo ordeno y te doy una versión que podrías usar casi literal 🍌

-Explica qué hiciste para comprobar y garantizar que la información proporcionada por la IA era correcta.

Lo principal, meterle muchas horas de trabajo, la captura muestra las horas dedicadas a la beca de TFM, con el 54% del tiempo (116 horas) destinado a leer y redactar el doc.



Mi proceso consistía en intentar pensar yo primero lo que quiero, y ya después pedir consejo a las IA. En ese punto, siento que es muy importante que el prompt sea lo más detallado y acotado posible. Además, triangulaba la información con mis tutoras y con la doctoranda de la línea de investigación. También con Pablo Najera para temas metodológicos (hice una reunión con el para cerrar métodos y posteriormente le mande dudas por correo una vez tenía ya los resultados)

Para cierto contenido, pasaba lo que me había generado una IA (chatgpt) por otra (Claude) preguntándole si erra correcto.

Declaración de veracidad:

Firmo y certifico que la información procedente de herramientas de IA ha sido verificada por mí mediante consulta de fuentes académicas primarias y que el texto final incorpora un trabajo de redacción, síntesis y reflexión personal.

Firma del/a alumno/a: _____

Fecha: 15/ Mayo/ 2026