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Working Paper

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Working Papers in Economics and Statistics, No. 2023-13

Provided in Cooperation with:
Institute of Public Finance, University of Innsbruck

Suggested Citation: Flecke, Sarah Lynn; Schwaiger, Rene; Huber, Jürgen; Kirchler, Michael (2023) : Nature experiences and pro-environmental behavior: Evidence from a randomized controlled trial, Working Papers in Economics and Statistics, No. 2023-13, University of Innsbruck, Research Platform Empirical and Experimental Economics (eeecon), Innsbruck

This Version is available at:
https://hdl.handle.net/10419/278628

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Working Papers in Economics and Statistics

2023-13

University of Innsbruck
https://www.uibk.ac.at/EconStat/

University of Innsbruck
Working Papers in Economics and Statistics

The series is jointly edited and published by

- Department of Banking and Finance
- Department of Economics
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Nature Experiences and Pro-Environmental Behavior: Evidence from a Randomized Controlled Trial

– Working Paper –

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We conducted a randomized controlled trial in a lab and natural setting to investigate whether exposure to nature leads people to behave more pro-environmentally. We further investigated whether attention restoration mediates this effect. Participants were randomly assigned to one of four conditions, in which they spent 15 minutes either walking through a park, walking through an urban area with limited greenery, viewing a video of a nature walk, or remaining seated in the lab (taking a break). Participants were given a EUR 10 endowment to keep for themselves or donate to either a conservation, social, or cultural charity. We measured the frequency and the amount donated to the conservation charity as indicators of pro-environmental behavior. We found that real nature exposure positively affects pro-environmental behavior compared to viewing a nature video. This effect was mediated by self-reported restoration, however, the mediator was not robust to controlling for environmental concern and nature identity, implying that attention restoration as a mechanism is driven by more environmentally concerned and connected individuals.

JEL classification: C93, Q50, Q51, D91

Keywords: pro-environmental behavior, nature experience, attention restoration, restorativeness, randomized controlled trial

1. Introduction

Humans are engaging in behavior that is causing permanent environmental damage, while global climate change continues to compromise agriculture, fisheries and ecosystems. Biodiversity loss has accelerated according to the "Living Planet Index", which tracks changes in the relative abundance of wild species populations over time. The monitored wildlife populations have declined by 69% between 1970 and 2018 (WWF, 2022), and 10,739 species are currently threatened (IUCN, 2022). Individual behavior plays a crucial role, as between 50% to 80% of global land, material, and water use and 60% and 72% of global greenhouse gas emissions are associated with the production and use of products and services consumed by households (Hertwich and Peters, 2009; Ivanova et al., 2016). If behavior is not altered, the risk of reaching a tipping point in the natural order increases, presenting a global catastrophe, such as ecosystem collapse (Kemp et al., 2022). Efforts to prevent further biodiversity loss are therefore of paramount importance for the environment and humanity.

With more people living in urban environments, characterized by limited access to nature and absence of biodiversity, we are collectively confronted with an "extinction of experience", describing the loss of direct connection to nature (Pyle, 2003). A loss of interaction with nature discourages positive emotions, attitudes, and behaviors towards the environment (see, e.g., a review by Soga and Gaston, 2016). This disassociation from nature is considered one of the highest research priorities for conservation, yet has received limited attention (see, e.g., a review by Jucker et al., 2018). Specifically, reconnecting people with nature and devising strategies to promote pro-environmental behavior may be critical for environmental protection.

1.1. Nature Experiences and Pro-Environmental Behavior

Evidence suggests that exposure to nature not only reduces the extinction of experience, but is associated with more pro-environmental behavior (PEB) (see meta-analysis by Whitburn et al., 2020). For example, spending time in nature during childhood is associated with stronger PEB in adulthood (Chawla and Derr, 2012; Evans et al., 2018). Alcock et al. (2020) find a positive relationship between recreational nature visits and nature appreciation and self-reported PEB, based on a representative survey of the English general population. There is also some evidence that virtual nature experience through videos or images may increase pro-environmental attitudes and behavior (Zelenski et al., 2015; Arendt and Matthes, 2016). Despite the large body of evidence examining the connection between nature experiences and PEB, much of it has focused on self-reported measures, rather than observed behavior. This is an important limitation, given the variability in the validity of self-report measures (Kormos and Gifford, 2014). Moreover, limited evidence from randomized controlled trials exists to provide causal evidence (Rosa and Collado, 2019).

1.2. Nature Experiences and Restoration

Limited causal evidence for the effect of nature experience on PEB also implies limited evidence for an underlying causal mechanism. Without randomized experimental evidence, it is unclear whether it is the case that nature experiences lead to greater PEB, or whether more pro-environmental individuals seek out nature experiences more frequently (reverse causality). If it is the former, what could be driving this effect? Nature has restorative properties, which, among others, are said to improve cognitive performance due to restoration of directed attention (Kaplan, 1987; Ohly et al., 2016; Stevenson et al., 2018). Attention restoration has been proposed as a possible mechanism by which nature experiences affect PEB. It has been suggested that the positive experience of being in nature makes people more likely to engage in acts that protect the environment from which they derive this benefit (Berto, 2014). In this sense, nature provides a positive utility that motivates PEB. Byrka et al. (2010) find that individuals who most strongly endorsed nature visitation as a means for their own psychological restoration, also reported the highest levels of PEB. Collado and Corraliza (2015) report that the restorativeness of schoolyards predicted the frequency of PEB in schoolchildren. However, in both studies, behavior was not observed, but self-reported. There is also evidence that positive emotional states as brought about through attention restoration, reduce the concern for the self and trigger a more collective mental frame, which leads to prosocial behavior more broadly (Schwartz et al., 2019).

1.3. Measuring Pro-Environmental Behavior

The limited causal evidence for an effect of nature experience on PEB stems in part from the practical challenge of measuring this type of behavior. One method of doing so in a controlled setting is to implement an environmentally-framed economic task. PEB has often been framed as a social dilemma (Van Lange et al., 2013), with public goods games used to simulate decision-making around environmental issues like climate change (e.g. Milinski et al., 2006, 2008; Brick and Visser, 2015) or overfishing (e.g. Gifford and Wells, 1991; Gifford and Gifford, 2000). However, as pointed out in the literature, the sustainable or pro-environmental outcome of a commons dilemma (like avoiding catastrophic climate change), is also the cooperative outcome (Lange and Dewitte, 2019). Participants choose to behave selfishly or cooperatively, with the latter resulting in an environmental outcome. However, cooperative behavior may involve different motivations than environmental behavior. In some cases, pro-environmental action might even be at odds with cooperative behavior (Zelenski et al., 2015; Klein et al., 2017). Klein et al. (2017) find that when subjects have to choose between cooperative and PEB, cooperation typically prevails, suggesting that cooperation is the main motivator in environmentally framed public goods games. However, many situations are characterized firstly by individual environmental action, which is not at odds with cooperation, nor requiring of coordination with others at the moment of decision-making. Thus, an experimental framework that decouples cooperative from environmental behavior, without creating a dichotomy or trade-off between them, constitutes an appropriate alternative paradigm for testing PEB in a controlled setting.

1.4. Current Study and Hypotheses

In the present pre-registered study,[1] we investigated whether exposure to nature leads people to behave more pro-environmentally and, furthermore, whether this relationship can be explained through the mechanism of attention restoration.

We randomly assigned 542 student participants to either a nature walk, an urban walk, a nature video, or a break condition of approximately 15-minute duration each. We measured pro-environmental behavior (PEB) post-intervention by providing participants with a windfall endowment of EUR 10 and gave them the choice to keep or donate any portion of it to either of three randomly presented charitable organizations supporting (1) nature conservation, (2) social welfare, and (3) arts and culture.[2] The frequency and amount of donations made to the conservation charity serve as our measures of PEB, as distinct from prosocial behavior (e.g., a donation to any charity). Importantly, donations came at a direct cost to the participants, as the amount was deducted from their payout, presenting a trade-off between selfish and PEB. We used two measures of attention restoration: (1) the difference in participants' attentional and cognitive fatigue before and after the intervention using the Digit Span Backwards (DSB) test (Tennessen and Cimprich, 1995), and (2) self-reported feelings of restoration. Though we acknowledge that there may be multiple channels through which the restorative qualities of nature influence environmental behavior, we treat attention restoration as a single mechanism and mediator. Participants completed additional surveys including questions on environmental attitudes, environmental identity, nature visitation habits and demographics at the end of the study.

We advance the existing body of literature in the following ways: first, we employ a rigorous experimental methodology by conducting an incentivized Randomized Controlled Trial (RCT), and measure observable PEB, rather than relying on self-reported measures. Our design necessitates a trade-off between selfish and environmental behavior; thus, our measure of PEB captures the personal cost of behaving pro-environmentally, which is also disentangled from cooperative behavior. We explore a potential mechanism driving the effect of nature experience on PEB by testing for attention restoration in two different ways. Lastly, we explore the potential of a nature video for providing restoration (see, e.g., Pilotti et al., 2015; Kimura et al., 2021) and affecting PEB, as a low-cost intervention for urban areas lacking natural spaces.

As outlined in our pre-analysis plan, we predicted that the portion of participants who donate to the nature conservation charity would be higher in the treatment groups assigned to the nature walk (NATURE) or the nature video (VIDEO) conditions (*Hypothesis 1*), and further, that the average donation amount to the nature conservation charity in those conditions would be higher compared to the URBAN and BREAK conditions respectively (*Hypothesis 2*). We also hypothesized that nature exposure would have an indirect effect on PEB via attention restoration (*Hypothesis 3*).

[1] The pre-analysis plan, the experimental software, the data, the analyses files, as well as all other relevant documents can be found in the OSF project repository.

[2] Note that participants made three independent decisions, one per charity, of how much from EUR 0-10 to donate / keep, and one organization was selected at random for which the choice was implemented. Further details about the procedure are provided in Section 2.2.

2. Experimental Design and Methods

2.1. Participants and Setting

The study was ethically approved by the Internal Review Board of the University of Innsbruck and funded by the Austrian Science Fund (FWF), SFB F63. Participants of this study were students of the University of Innsbruck ($N = 542$), recruited from the university's EconLab database. The average age was 22.5 years and the sample comprised of 64% women. Participants were randomly assigned to either a nature walk ($N = 138$), a nature video ($N = 133$), an urban walk ($N = 139$), or a break ($N = 132$) condition, each lasting approximately 15 minutes:

- Participants in the **NATURE** condition were asked to take a walk in a park (Hofgarten, Innsbruck), featuring greenery, a mountain backdrop and a pond.
- Participants in the **URBAN** condition were asked to take a walk in central Innsbruck, towards the main train station, in an urban and trafficked area with limited greenery.
- Participants in the **VIDEO** condition were asked to remain in the lab and watch a point-of-view video with audio of a nature walk, featuring greenery, birdsong and a lake.
- Participants in the **BREAK** condition were asked to remain in the lab and take a break from the previous tasks in silence.

See Figure 1 for representative images of the four treatment conditions. Participants were aware when signing up, that the study was incentivized. They received a show-up fee of EUR 2, in addition to a variable component. The study was conducted in the city of Innsbruck, Austria, over a 5-week period from October 3 to November 8 2022, between 9:00am and 3:00pm. Per experiment day, four lab sessions were conducted, each accommodating a maximum of 24 participants. Each condition was run once per experiment day to reduce weather or day-specific fixed effects. The weather over the period of the study was fair, with temperatures ranging from 10 to 22 degrees centigrade, and no precipitation recorded on any of the days the experiment was conducted. To limit distraction and avoid multiple sets of instructions, participants within each lab session were assigned to the same treatment condition. This also obscured participants' awareness of other conditions. Each day, the order of the sessions (conditions) was randomized and participants were randomly allocated to a seat in the lab. Participants were unable to discern any allocation pattern or any information about the conditions when signing up for the study. The study was administered in German.

Figure 1: Visual representation of the treatment conditions

(a) NATURE: Hofgarten (last day of data collection)

(b) URBAN: View to central station on route

(c) VIDEO: Nature walk video (screenshot)

(d) BREAK: University of Innsbruck's EconLab

2.2. Procedure

The study comprised of three parts, outlined in detail in the following sections. Participants first completed a survey and task in the lab on the computer[3], before proceeding to their assigned intervention. After the intervention, they completed further tasks and surveys in the lab on the computer. Please see Figure 2 for an overview of the study procedure.

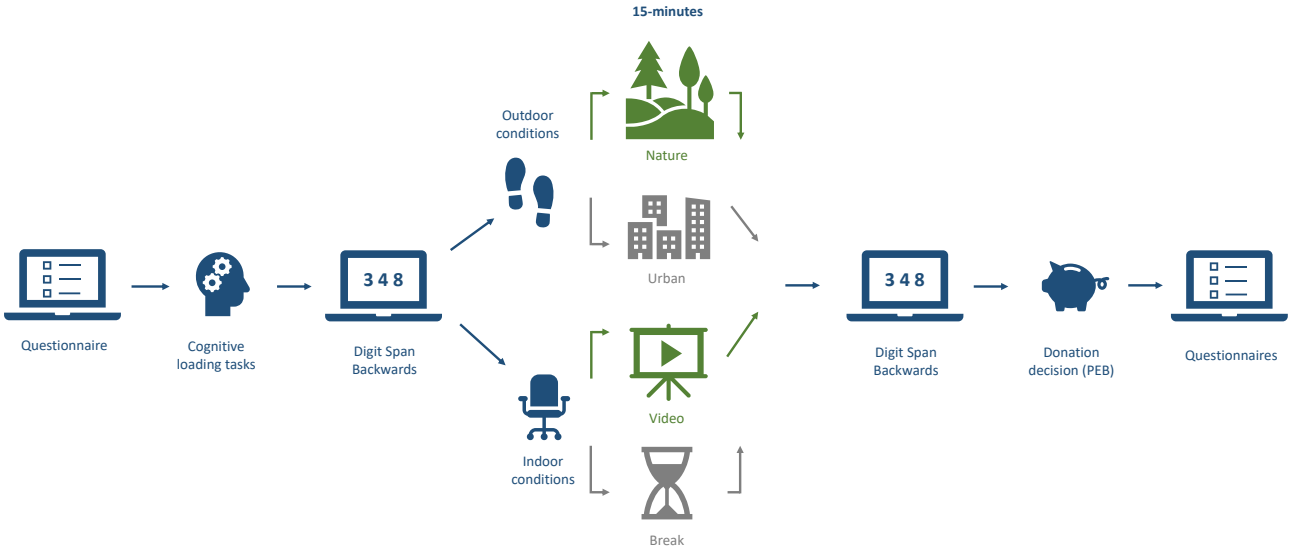
2.2.1. Part 1 - Lab

Participants were informed of the approximate study duration and provided a consent form. They were instructed not to communicate with anyone throughout the study, and asked to silence and give up their phones, which they could only retrieve upon completion of the full study. Instructions were given on-screen.

The first set of questions elicited participant's levels of concern about ten current societal issues on 5-point Likert scales presented in random order, ranging from AI ethics to immigration. One

[3] English translation of the instructions and all included surveys can be found in Section C in the Appendix.

Figure 2: Flowchart of the Study Procedure



item was included about concern for global climate change and one about concern for biodiversity conservation, whereby the average of these two items served as indication of participant's general environmental concern. We introduced these in a set with eight other current societal issues to avoid potential priming effects. Elicitation before any of the treatments allowed us to later test and control for potential imbalances in environmental concern between conditions.

Participants were then given a cognitively demanding task to complete, in order to induce attentional and cognitive fatigue.[4] Participant's attentional and cognitive fatigue were measured using the Digit Span Backwards (DSB) test (Tennessen and Cimprich, 1995), which we adapted for digital use in the lab (see an image of "Task 3" in Subsection C.1 in the Appendix). The DSB is a validated measure, which forms part of the Wechsler intelligence and memory scales for adults and children (Wambach et al., 2011) and has been used to assess cognitive fatigue (see Berman et al., 2009). Participants were required to recall a number in reverse order with progressively more digits. The amount of correctly recalled numbers, as well as the maximum number of correctly recalled digits was recorded for each participant. Participants were required to complete all 14 rounds, rather than ending the task after failure to recall a number, as the task itself could cause some additional fatigue.

2.2.2. Part 2 - Intervention

Participants then proceeded to their allocated intervention, either by remaining in the lab (VIDEO or BREAK), or by exiting the university building and either entering the adjacent park, called Hofgarten (NATURE), or walking towards the central train station in a trafficked urban area (URBAN). Due to the inherent differences in completion time of the first part of the experiment, participant departure from the lab these two conditions was staggered. This meant that participants did not form groups, but proceeded to the assigned route individually. This helped ensure participants experienced their surroundings with minimal interference.

[4] The cognitive task involved a mathematical and word-based task, each for a duration of 2 minutes. Details can be found in Section C of the Appendix.

Participants in both outdoor conditions were instructed to walk within their respective environment for approximately 15 minutes, which was the estimated duration of the circular route they needed to follow in both cases. For participants in the indoor conditions (BREAK, VIDEO), the study proceeded automatically after 15 minutes. In this way, none of the participants had to keep track of time or felt under time pressure, but the intervention duration was consistent across conditions.

In line with Kaplan's theory and corroborated in various studies, certain elements of the natural environment have been found to be most restorative. The "fascination" component of Attention Restoration Theory, which is defined as being effortlessly engaged in the experience (Kaplan, 1995), has been shown to be a key factor in restorative experiences (Collado and Corraliza, 2015). Therefore, environments featuring greenery (Lohr and Pearson-Mims, 2006; Nordh et al., 2009; Hartig et al., 2014), water (Han, 2010; White et al., 2010), and sounds of birdsong and running water (Alvarsson et al., 2010; Benfield et al., 2014; Medvedev et al., 2015) are particularly restorative. Moreover, nature images, videos, audio recordings and virtual reality experiences have been shown to trigger restoration (see Snell et al., 2019; Kimura et al., 2021; Mostajeran et al., 2021). For this reason, the selected video consists of a walk through a forest, next to a lake, with nature sounds, including birds and water ripples (see Figure 1c for a screenshot of the video). Similarly, the nature walk through the park (NATURE) passed by a small pond, while the walk through the urban environment (URBAN) featured a limited number of trees and greenery and no water (see Figures 1a and 1b for representative images of the surroundings).

We provided participants in the outdoor conditions with route descriptions and a basic map displaying landmarks along the path. These handouts have been included in Section C of the Appendix. We instructed participants to arrive at a specific meeting point in the park and at the train station, respectively, where an assistant checked them off the participant list. This allowed us to verify that participants followed the correct path and remained in the assigned environment for the expected amount of time.[5]

[5] It is worth noting that the Hofgarten is located directly next to the social sciences faculty (SOWI), where the lab is situated, and is well-known by students and Innsbruck residents. Similarly, the location of the main train station is common knowledge and a well-known city landmark. This implies a similar level of familiarity with the selected locations and in both cases the exposure to the environment begins almost immediately upon exiting the lab. There are only two conceivable paths (both equidistant) that lead from the social sciences faculty to the train station. We used the one path as the route to the station and the other path as the return route, providing a simple circular route. Thus, by design, neither of the selected routes would have been unfamiliar, confusing, or difficult for the participants to navigate.

2.2.3. Part 3 - Lab

After the intervention, participants in the outdoor conditions returned to the lab, while those in VIDEO and BREAK remained there. Participants were asked to indicate how restored they felt after the 15-minute activity or break on a 5-point Likert scale.[6] All participants then completed the DSB test again, to measure post-intervention cognitive fatigue.

Participants were then informed that they had a EUR 10 endowment available and were asked to make a decision about how to use it. They were given the option of donating any portion of it to a charitable organization and keeping the remainder for themselves (i.e., any amount from 0 to 10 could be donated or kept). Participants were presented with three charities in random order, one environmental conservation organization, one social welfare organization, and one organization fostering arts and culture. In our study, donation behavior towards the nature conservation charity served as a measure of PEB. By presenting two charities, focused on different issues as alternative choices, we aimed to minimize any experimenter demand effects that could arise from the participants associating the nature video or outdoor walks with the conservation charity. Furthermore, it allowed for differentiation between pro-environmental and prosocial actions. All organizations were Austrian non-for-profits, operating at a national scale.[7] This ensured relatively equal, limited renown of charities, and reduced the odds of one being preferred based on its prominence.

In order to obtain decision data of each participant for *all* charities, participants made three independent decisions (with an endowment of EUR 10 each), and were told they could choose how much to donate to each charity and how much to keep for themselves, but that only one charity would be selected at random. Thus, only the associated donation decision was implemented and a maximum of EUR 10 was donated (akin to the strategy method). Participants were informed that each charity had the same probability of being chosen. To advance to the donation stage, participants had to correctly answer 4 comprehension questions (see "Financial Decision" in Subsection C.8 in the Appendix).

After entering their financial decisions, participants were asked to complete the revised Environmental Identity (EID) scale (Clayton, 2003; Clayton et al., 2021), and the widely used New Environmental Paradigm (NEP) scale (Dunlap et al., 2000). Environmental identity "incorporates emotional, behavioral, and cognitive aspects of a person's perceived relationship to the natural world" (Clayton et al., 2021, p. 2) and has been shown to be a strong predictor of behavior (Tam, 2013). Since identity is considered stable, we did not expect the measure to be influenced by the treatments. We also elicited participants average weekly nature visitation habits, what kind of environment they grew up in (urban, rural etc.), and how long they have been living in Innsbruck, and, in the NATURE and URBAN conditions, their perception of the pleasantness of the weather, as well as basic demographic information.

[6] Note that we used the German word "erholt", which captures the notion of restoration well, as it implies both a physical and mental recovery, and also invokes feelings of rest and refreshment.

[7] "Naturschutzbund Österreich", "Hilfswerk Österreich", and "IG Kultur Österreich", respectively.

2.2.4. Data Analysis

We conducted the subsequent analyses in accordance with our pre-analysis plan, registered on the Open Science Framework (OSF).[8] According to our a priori power analysis, we set out to collect a total sample of 500 student participants, with 125 individuals per condition.[9] We used significance levels α of 5% and 0.5%, respectively, for all analyses in this paper and applied robust standard errors in all linear regression models where applicable, covering potential issues of heteroskedasticity. We calculated variance inflation factors (VIF) for each explanatory variable and found that each VIF was under 1.6, indicating no risk of inflated standard errors of the coefficients due to multicollinearity.

We did not treat any specific condition as the control group, but made pairwise comparisons of donation behavior and restoration between each of the four conditions. The different pairwise comparisons can provide different insights, which a single control treatment could not:

- NATURE VS URBAN: The comparison between the two outdoor conditions aims to isolate the importance of the nature environment, while keeping physical activity (walking outdoors) constant.
- VIDEO VS BREAK: Comparing the two indoor (seated) conditions aims to determine the impact of exposure to virtual nature in a controlled setting.
- NATURE VS VIDEO: Both stimuli contain natural elements like greenery, birdsong, and blue spaces, but activity level and environment differ. This comparison aims to provide a better understanding of the impact of real versus virtual nature.
- BREAK VS NATURE: This comparison helps to discern whether the act of taking a break causes behavioral differences, or whether the natural environment and activity play a more critical role.

The two remaining comparisons (URBAN VS BREAK and URBAN VS VIDEO) are not directly covered by any of our hypotheses.

[8] OSF project repository.

[9] Thereby, we achieved a power of at least 80% to reliably detect a small to medium sized standardized effect equal to or larger than Cohen's $h/d = 0.35$, given a Type I error rate of $\alpha = 0.05$ in two-sided equality of proportions z-tests and two-sided unpaired sample t-tests .

3. Results

Before conducting the primary analyses, we performed sample balancing checks to ensure we had equal sample characteristics across all conditions. From Table A19 it can be seen that the conditions were balanced across age, gender, years living in Innsbruck, upbringing (rural/urban), and average time spent in nature per week. However, we found that the NATURE condition was comprised of more environmentally concerned participants, as indicated by their (pre-intervention) self-reported concern for the environment. As discussed in more detail below, we controlled for this imbalance. We performed analyses on the full sample.[10] An overview of descriptive statistics can be found in Section A1 in the Appendix.

3.1. Pro-Environmental Behavior

Pro-Environmental Behavior (PEB) Measure 1: Portion of participants who donated to the conservation charity

First, we compared the portion of participants who donated any non-zero amount to the conservation charity across conditions to determine whether the treatments influenced willingness to give at all, irrespective of the amount (PEB Measure 1). Although the percentage of participants who donated was highest in the NATURE condition, (see Figure 3a), contrary to our hypothesis (H1), the differences were not statistically significant (two-sided unpaired sample z-tests of proportions; NATURE $-$ VIDEO: $0.746 - 0.707 = 0.039$, $z = 0.730$, $\mathrm{p} = 0.464$; NATURE $-$ BREAK: $0.746 - 0.727 = 0.191$, $z = 0.360$, $\mathrm{p} = 0.721$; NATURE $-$ URBAN: $0.746 - 0.662 = 0.084$, $z = 1.540$, $\mathrm{p} = 0.123$; see Table A8 in the Appendix for further statistical details of all other pairwise comparisons).

We conducted a multivariate logistic regression model, with the dependent variable a binary dummy of whether participants made a donation (see Table 1). The dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference category. Post-estimation Wald-Tests for pairwise comparisons of all other conditions in each model were calculated and test statistics (Chi^2) are reported. Cluster-robust standard errors at the session level (31 clusters) were applied. Descriptions of included variables can be found in Appendix Section B.

We ran three models in total, which allowed for verification of the robustness of our main findings, and to discern the effect of control variables more cleanly. Model I consists only of the treatment conditions as independent variables (reference category is the NATURE condition). In Model II, we additionally accounted for the detected imbalance in the sample, by controlling for participants'

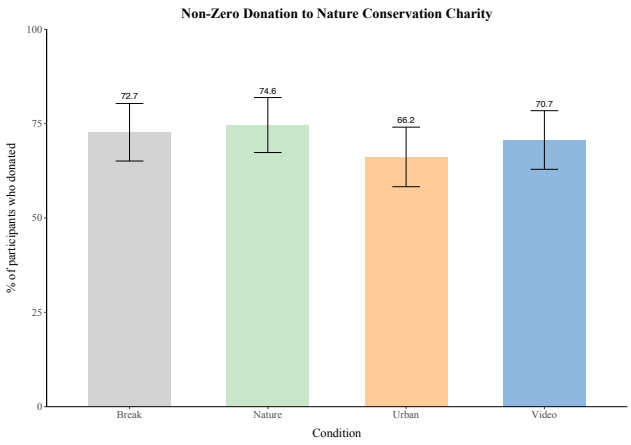
[10] We originally sampled 543 individuals. One individual in our sample self-report gender as "non-binary", which, due to the sample size of 1, meant that this observation was necessarily excluded by the statistical software from the models where we included the variable gender, as the coefficient for this category was not estimable. Since not all models control for gender, this would have implied a different sample size for different analyses and models. To maintain consistent sample sizes across all analyses, we, therefore, excluded this single observation and ended up with 542 participants in the full sample.

environmental concerns. In Model III, we further added all measured covariates, including gender, age, upbringing, average weekly hours spent in nature, years living in Innsbruck, subjective weather assessment, and environmental identity (EID). We found no statistically significant differences between conditions across all three models for PEB Measure 1.

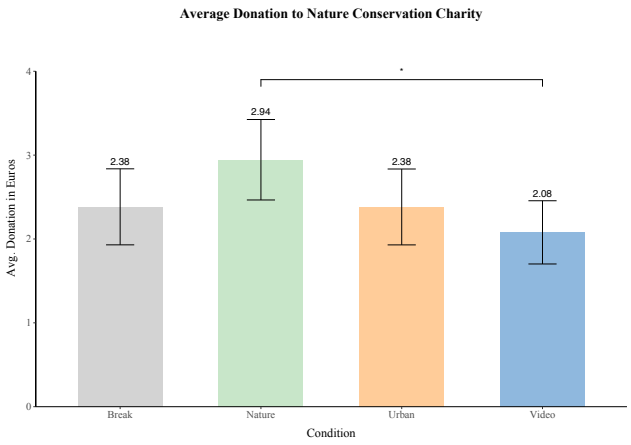
Pro-Environmental Behavior (PEB) Measure 2: Amount donated to the conservation charity

We further investigated whether the Euro-amount donated to the nature conservation charity differed between conditions (PEB Measure 2). As seen in Figure 3b the highest average donations to the conservation charity were made by participants in the NATURE condition (EUR 2.94). This difference (Cohen's $d = 0.337$) was statistically significant compared to participants in the VIDEO condition (two-sided unpaired sample t-test; NATURE − VIDEO: $2.945 - 2.382 = 0.563$, $t(269) = 2.769$, $p = 0.006$), but not compared to the other two conditions (two-sided unpaired sample t-tests; NATURE − BREAK: $2.945 - 2.383 = 0.562$, $t(268) = 1.664$, $p = 0.097$, NATURE − URBAN: $2.945 - 2.382 = 0.563$, $t(275) = 1.670$, $p = 0.095$) providing partial support for our second hypothesis (see Table A9 in the Appendix for further statistical details of all other pairwise comparisons).

Figure 3: Measures of Pro-Environmental Behavior (PEB)



(a) PEB Measure 1: Portion of participants (%) who made any donation to the nature conservation charity by condition. Portions do not differ significantly between conditions (two-sided unpaired sample z-tests of proportions). The whiskers show 95% confidence intervals. Figures on top of the upper 95% confidence intervals show mean values.



(b) PEB Measure 2: Average donation (EUR) to nature conservation charity by condition. $^*p < 0.05$, $^{**}p < 0.005$ (two-sided unpaired sample t-tests). The whiskers show 95% confidence intervals. Figures on top of the upper 95% confidence intervals show mean values.

We also specified a marginal effects fractional response models with logit link, and the fraction of the total individual endowment (EUR 10) that was donated to the nature conservation charity as the dependent variable, utilizing the same set of independent variables as outlined in the description on the analysis of PEB Measure 1. We report the results in Table 2, which corroborate the results from the two-sided unpaired sample ttests (see Model I in Table 2). The coefficients for each condition indicate the percentage point change in the portion of the total endowment of EUR 10, donated to

the conservation charity, relative to the reference condition (NATURE). Our model predicted that shifting from the NATURE condition to the VIDEO condition constitutes an 8.70 percentage point decrease in portion of endowment donated.

Again, we conducted three models, each including a different set of covariates. The results remained robust in all three models, as the difference between the NATURE and VIDEO condition remained statistically significant. We further observed that the participants' environmental concern significantly predicted PEB, as indicated in Models II and III. In particular, a higher level of environmental concern by one point on the 5-point scale was associated with an increase in the fraction of the endowment donated to the conservation charity by 9.60 percentage points. Gender also emerged as a significant predictor, whereby being female was associated with an increase in the portion of endowment donated by 8.10 percentage points (see Model III).[11]

[11] To assess the robustness of our findings, we conducted additional subset analyses by making pairwise comparisons between conditions while accounting for the specific levels of covariates associated with each condition. The results, which consistently confirm our initial findings, are shown in Tables A11 and A12 in the Appendix for the logistic (PEB measure 1) and fractional regressions (PEB measure 2), respectively.

Table 1: Multivariate marginal effects logistic regression models on an indicator for donations made to the nature conservation charity. The dependent variable is a binary dummy of whether participants made a donation. Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0-4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level (31 clusters). Post estimation Wald tests show test statistics (Chi^2). *p < 0.05, **p < 0.005.

	Model (I)	Model (II)	Model (III)
Condition (Reference: NATURE)			
BREAK	−0.019	0.007	0.018
	(0.054)	(0.053)	(0.041)
VIDEO	−0.040	−0.005	0.009
	(0.054)	(0.053)	(0.051)
URBAN	−0.085	−0.059	−0.043
	(0.055)	(0.054)	(0.048)
Environmental Concern			
EVNIRON. CONCERN		0.144**	0.091**
		(0.025)	(0.026)
Gender (Reference: MALE)			
FEMALE			0.165**
			(0.052)
Upbringing (Reference: RURAL)			
MIXED RURAL & URBAN			0.050
			(0.060)
SMALL CITY			−0.024
			(0.055)
LARGE CITY			0.114*
			(0.052)
Hours in Nature (Reference: $0-4$)			
$5-9$			0.080
			(0.042)
$10-14$			0.089
			(0.077)
$15-20$			0.013
			(0.084)
>20			−0.072
			(0.096)
Other Control Variables			
AGE IN YEARS			−0.009
			(0.007)
ENVIRON. IDENTITY SCALE (EID)			0.112*
			(0.052)
SUBJ. WEATHER			0.011
			(0.018)
YEARS IN INNSBRUCK			−0.006*
			(0.002)
Observations	542	542	542
Prob > Chi^2	0.453	0.000	0.000
Pseudo R^2	0.004	0.049	0.119
Post Estimation Wald-Tests (Chi^2):			
BREAK VS. VIDEO	0.137	0.052	0.031
BREAK VS. URBAN	1.374	1.475	1.553
VIDEO VS. URBAN	0.636	0.976	0.891

Table 2: Multivariate marginal effects fractional regression on the portion of total endowment donated to the nature conservation charity. The dependent variable is represented by the fraction of the endowment of EUR 10 donated to the conservation charity. Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0 - 4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level (31 clusters). Post estimation Wald tests show test statistics (Chi^2). $^{*}p < 0.05$, $^{**}p < 0.005$.

	Model (I)	Model (II)	Model (III)
Condition (Reference: NATURE)			
BREAK	−0.056	−0.039	−0.036
	(0.031)	(0.032)	(0.030)
VIDEO	−0.087**	−0.065*	−0.063*
	(0.026)	(0.030)	(0.026)
URBAN	−0.056	−0.041	−0.031
	(0.035)	(0.032)	(0.034)
Environmental Concern			
EVNIRON. CONCERN		0.117**	0.096**
		(0.020)	(0.021)
Gender (Reference: MALE)			
FEMALE			0.080**
			(0.028)
Upbringing (Reference: RURAL)			
MIXED RURAL & URBAN			0.009
			(0.027)
SMALL CITY			0.004
			(0.033)
LARGE CITY			0.043
			(0.037)
Hours in Nature (Reference: $0 - 4$)			
$5 - 9$			0.013
			(0.039)
$10 - 14$			0.016
			(0.044)
$15 - 20$			−0.023
			(0.053)
> 20			0.014
			(0.063)
Other Control Variables			
AGE IN YEARS			−0.001
			(0.005)
ENVIRON. IDENTITY SCALE (EID)			0.046
			(0.039)
SUBJ. WEATHER			0.009
			(0.009)
YEARS IN INNSBRUCK			−0.000
			(0.002)
Observations	542	542	542
Prob > Chi^2	0.007	0.000	0.000
Pseudo R^2	0.005	0.028	0.039
Post Estimation Wald-Tests (Chi^2):			
BREAK VS. VIDEO	1.517	0.779	1.027
BREAK VS. URBAN	0.000	0.005	0.018
VIDEO VS. URBAN	1.036	0.663	1.154

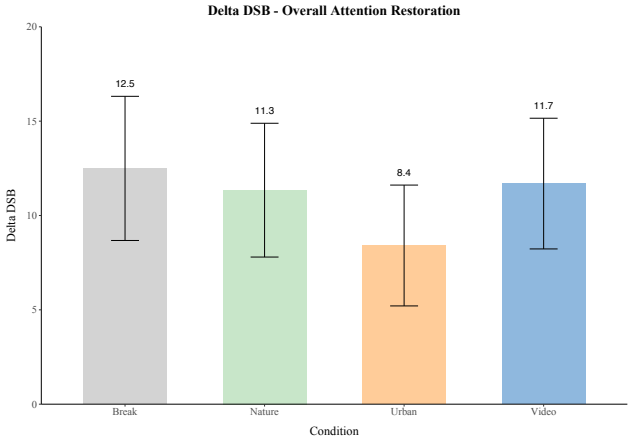
3.2. Attention Restoration

To further understand the effect of nature exposure on PEB, we considered attention restoration as a possible mechanism. We calculated participants' Digit Span Backwards (DSB) score by multiplying the total number of correctly recalled values by the highest number of correctly recalled digits. This allowed for more variation between subjects than merely recording the highest attained number or the total number of correct responses. We used the average pre-intervention DSB score as the baseline level and measured attention restoration by subtracting the pre-intervention from the post-intervention DSB score. As a manipulation check we examined differences in attention restoration before and after the intervention. A comparison of pre- and post- DSB scores applying two-sided paired sample t-tests, revealed that the post-intervention scores were significantly higher across all four conditions. This increase in scores post-intervention, evident in Table A5 in the Appendix, suggests that, following tasks which induced cognitive fatigue, the interventions effectively restored participants' attention. Thus, a 15-minute break (doing nothing, viewing a video, or going for a walk) appears to provide restorative benefits. It is important to note that the observed effect could be attributed in part to learning effects.

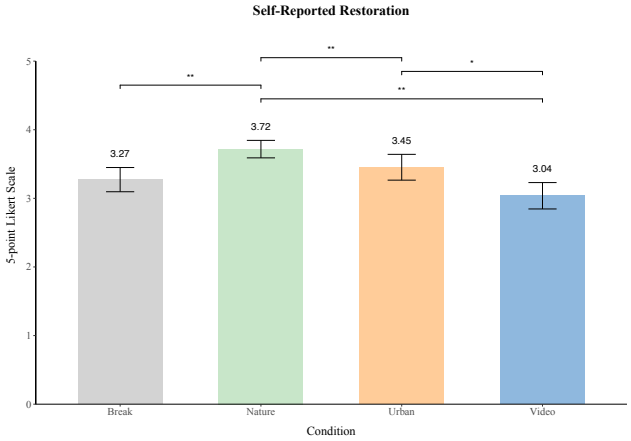
Contrary to our prediction, we did not find statistically significant differences between conditions in the attention restoration measure using the DSB test (OLS regression with ΔDSB SCORE as the dependent variable and dummies for the conditions as independent variables, as well as two-sided unpaired sample t-tests). As seen in Figure 4a, the changes in DSB measures from pre- to post-intervention are not statistically distinguishable across conditions, implying that they were similarly cognitively restoring. For full statistical outputs, see Tables A6 and A10 in the Appendix.

However, we also elicited self-reported feelings of restoration, and here a different picture emerged. We found that the nature condition was significantly more restorative compared to all other conditions (see Figure 4b). This suggests that participants subjectively experienced the walk outside as most restorative. Notably, participants shown the video felt less restored than participants assigned to the nature walk (two-sided unpaired sample t-test; NATURE $-$ VIDEO: $3.717 - 3.038 = 0.679$, $t(269) = 5.817$, $p = 0.000$; $d = 0.704$). Indeed, even the URBAN condition was more restorative than the VIDEO condition (two-sided unpaired sample t-test; NATURE $-$ VIDEO: $3.453 - 3.038 = 0.415$, $t(270) = 3.030$, $p = 0.003$; $d = 0.368$), suggesting that an active condition was preferable (for statistical details of all pairwise comparisons, see Table A7 in the Appendix). We offer some explanations for these findings in the discussion section.

Figure 4: Attention Restoration



(a) Attention restoration per condition, as measured via the difference between the pre-intervention and post-intervention Digit Span Backwards (DSB) test scores. Two-sided unpaired sample t-tests. The whiskers show 95% confidence intervals. Figures on top of the upper 95% confidence intervals show mean values.



(b) Self-reported restoration per condition, measured on a Likert scale from 1-5. *p $<$ 0.05, **p $<$ 0.005 (two-sided unpaired sample t-tests). The whiskers show 95% confidence intervals. Figures on top of the upper 95% confidence intervals show mean values.

We additionally explored the role of attention restoration as a possible mechanism for the effect of nature on PEB. We tested whether restoration partially or fully mediates the relationship between nature exposure and PEB (*Hypothesis 3*). We employed a mediation model based on the "paramed" package in Stata and posited a causal chain between nature, attention restoration, and PEB, where exposure to nature serves as the independent variable, attention restoration represents the mediator, and PEB is the dependent variable. Based on our main result of a total effect of nature experience onPEB compared to video exposure, we focused on the effect of condition NATURE compared to condition VIDEO. (Analyses for NATURE vs. URBAN vs. BREAK can be found in Tables A17 and A18 in the Appendix.)

We identified relevant control variables for our mediation analyses between conditions VIDEO and NATURE by examining whether any additional variables are correlated with either our treatment (exposure to nature vs video), our mediator (attention restoration) or our outcome variable (PEB), as this would confound the analysis. We report the results of Spearman and Pearson correlation analyses in Appendix Table A19. Columns (2) and (10) show significant differences in environmental concern between participants in the NATURE and VIDEO conditions (treatment). Columns (1) and (10) indicate a significant association between environmental concerns and PEB (outcome). We also found that EVNIRON. CONCERN correlates with our outcome measure, the treatment, and one mediator (SUBJECTIVE RESTORATION), as does the participants' environmental identity (ENVIRON. IDENTITY SCALE (EID)).[12]

[12] This violates the first 3 of 4 key assumptions for accurate estimation of direct and indirect effects, namely: 1) there are no confounding variables impacting both the exposure and the outcome (otherwise they must be included in the model); 2) there are no confounding variables that affect both the mediator and outcome, which is especially relevant to avoid collider bias (otherwise they must be included in the model); and 3) there are no confounding variables that affect both the exposure and mediator (otherwise they must be included in the model) and 4) any confounding variables that affect both the mediator and outcome must not be affected by the exposure variable. Including such a confounding variable

Table 3: Paramed Mediation Analyses (VIDEO vs. NATURE) on the absolute amount donated to the conservation charity. To properly account for a potential interaction effect between the exposure variable NATURE and our mediators SUBJECTIVE RESTORATION, and ΔDSB SCORE, we estimated a controlled direct effect at a level of zero of the respective mediator, as well as a natural direct effect based on the actual level of the mediators in condition BREAK, which served as the reference category. Control variables are EVNIRON. CONCERN and ENVIRON. IDENTITY SCALE (EID). Standard errors in parentheses. $^{*}p < 0.05$, $^{**}p < 0.005$.

	Effect: NATURE → PRO-ENVIRONMENTAL BEHAVIOR (PEB)			
	Mediator: ΔDSB SCORE		**Mediator**: SUBJ. ATT. REST.	
	Model (I)	Model (II)	Model (III)	Model (IV)
CONTROLLED DIRECT EFFECT	0.743*	0.537	−1.559	−1.485
	(0.360)	(0.352)	(1.258)	(1.233)
NATURAL DIRECT EFFECT	0.852*	0.636*	0.406	0.305
	(0.315)	(0.310)	(0.370)	(0.363)
NATURAL INDIRECT EFFECT	−0.001	−0.001	0.460*	0.345
	(0.009)	(0.007)	(0.210)	(0.197)
MARGINAL TOTAL EFFECT	0.851*	0.635*	0.866*	0.650*
	(0.315)	(0.310)	(0.316)	(0.310)
Observations	271	269	271	270
Control Variables	No	Yes	No	Yes

Thus, we controlled for both EVNIRON. CONCERN and ENVIRON. IDENTITY SCALE (EID) in our analyses.[13] Our main mediation analyses results are presented in Table 3. To properly account for a potential interaction effect between the exposure variable NATURE and our mediators SUBJECTIVE RESTORATION and ΔDSB SCORE, we estimated a controlled direct effect at a level of zero of the respective mediator, as well as a natural direct effect based on the actual level of the mediators in condition VIDEO, which served as the reference category. Models (I) and (III) show the results without the two control variables and Models (II) and (IV) show the results with the two control variables.

The calculated marginal total effects support our previous results. We observed greater PEB in condition NATURE compared to condition VIDEO. We did not find an indirect effect on PEB through attention restoration as measured by the Digit Span Backwards test (ΔDSB SCORE), but there was a significant natural direct effect, which remained robust when controlling for EVNIRON. CONCERN and ENVIRON. IDENTITY SCALE (EID) (see Models I and II). From Model III we can observe, however, that

would remove some of the variation in the outcome that is directly caused by the exposure, making the estimate of the direct effect of nature experience on PEB biased towards zero.

[13] Design-wise, EVNIRON. CONCERN does not violate the fourth assumption as it is pre-treatment, and ENVIRON. IDENTITY SCALE (EID) does not as it is not treatment-correlated.

the effect of nature experience on PEB was statistically significantly mediated by SUBJECTIVE RESTORATION. Nevertheless, this effect became non-significant when controlling for EVNIRON. CONCERN and ENVIRON. IDENTITY SCALE (EID).

In sum, we found an indirect effect of nature experience on PEB through subjective restoration, but this was explained by people's identity to nature and their levels of environmental concerns. This in turn suggests that attention restoration as a mechanism was driven by more environmentally concerned and connected individuals.

3.3. Secondary and Exploratory Analyses

We also examined patterns in donation behavior by comparing donations to the different charities, as well as general giving to any charity across conditions. Descriptive statistics on the portion of donations and the average amount given to each charity per condition can be found in Tables A2 and A3 in the Appendix respectively.

To analyze the donation behavior across the three charities we conducted marginal effects logit and a fractional regression models for each experimental condition. The logit models used a binary dummy variable indicating whether participants made any non-zero donation, while the fractional regression models used the fraction of the endowment donated. Tables A15 and A16 in the Appendix show the comprehensive results. Our data revealed that donations to the nature conservation organization, both in frequency and amount, outmatched those to the art and culture charity across all conditions. The social welfare organization also received more frequent and higher donations than the art and culture charity, regardless of the treatment condition. This suggests a preference of causes among participants.

We additionally examined whether willingness to give at all, as well as the average donation amount made to any charity, differed between conditions. This willingness to donate can be considered an indication of prosocial behavior. Table A4 in the Appendix shows descriptive statistics. We conducted statistical analyses using marginal effects logit and fractional regression models. As dependent variables, we utilized a binary indicator denoting any non-zero contributions to any of the three charities and the average portion of the endowment that was donated across all charities, respectively. The detailed results are found in Tables A13 and A14 in the Appendix.

Our findings indicate that a significantly greater portion of participants in the NATURE and VIDEO conditions donated to any of the three charities, compared to those in the URBAN condition (see Model I in Table A13). However, the difference between the NATURE and the URBAN condition became insignificant upon controlling for environmental concern, thus accounting for sample imbalances. Participants in the NATURE condition donated significantly more generously than those in the VIDEO condition (see Model I in Table A14). This result is consistent with PEB Measure 2. However, this difference also became insignificant when controlling for environmental concern. This suggests that

the greater number of environmentally concerned individuals in the NATURE condition were driving this effect. It is evident that more environmentally concerned individuals were more generous, as they gave significantly higher amounts to all charities.

Finally, we also investigated the role environmental attitudes may play in the effect of nature exposure on PEB. Since we elicited participants' environmental attitudes at the end of the study, we considered that the conditions might have influenced responses to the NEP scale.[14] Furthermore, it is possible that attitudes could have affected PEB. We, therefore, did not include attitudes in the main regression models to avoid underestimating the total effect, but treated it as a mediator. We examined via Spearman and Pearson correlation analyses, whether attitudes were correlated with treatment conditions, and found that they were not (see Table A19, Row (3), Column (2) for Pearson ($p = 0.648$) and Row (2), Column (3) for Spearman ($p = 0.277$) correlations respectively). We conducted a mediation analysis with environmental attitudes as the mediator, a dummy variable that equals 1 for condition NATURE and 0 for condition VIDEO (exposure) and donations to the conservation charity as the outcome. We report the results in Table A20 in the Appendix. As can be seen from both models, there was no indirect effect of nature exposure via environmental attitudes on donations to the conservation charity. Neither did we find a significant direct effect of environmental attitudes on donations to the conservation charity, when controlling for sampling imbalances. Thus, we did not find that environmental attitudes explain the difference between conditions.

4. Discussion and Conclusion

The importance of human connection with nature has been well-documented. Nature experiences are important for health and well-being (Jimenez et al., 2021), with restoration of attentional capacity cited as a key benefit (Berto, 2014). There is also evidence of a connection between time spent in nature and pro-environmental attitudes (Soga and Gaston, 2016) and behavior (Whitburn et al., 2020). However, causal evidence of nature experiences leading to pro-environmental behavior (PEB) is limited. Moreover, evidence of observed, rather than self-reported, behavior in the literature is sparse. In this study we set out to address these research gaps by testing and understanding the causal effects of nature experience on PEB and whether attention restoration mediates this relationship. We conducted a randomized controlled trial in which we measured attention restoration and PEB after 15 minutes spent in a natural environment, in an urban environment, watching a nature video, or taking a break in the lab.

We measured participants' PEB by providing them with a EUR 10 windfall endowment and the choice to keep or donate any portion of it to one of three charitable organizations operating at the national level: a nature conservation organization, a social welfare organization, and an arts and culture organization. Donations to the nature conservation organization (whether any non-zero donation was

[14] We intentionally placed the scale after the intervention to avoid priming participants.

made, and the portion of endowment donated) served as our measures of PEB. Importantly, donations came at a direct cost to the participants, as the amount was deducted from their endowment, and thus, their final payout. This also mirrors the cost of individual environmental action.

We found that participants randomly assigned to a 15 minute nature walk (NATURE) donated higher amounts on average to the conservation charity compared to participants in the video condition, but not compared to participants in other conditions, providing some causal evidence for real nature experiences triggering PEB. We further observed that women, more environmentally concerned individuals and those with a stronger environmental identity behaved more pro-environmentally. The proportion of participants in the NATURE condition who donated to the conservation organization was not, however, significantly greater compared to any other condition. Thus, we did not find evidence that willingness to give at all was affected by the treatment, but we did find evidence that the willingness to give greater amounts was. This could indicate that real nature experience amplifies PEB.

We additionally found that the overall portion of participants who donated to any of the three charities was higher in the NATURE and VIDEO conditions, relative to the URBAN condition, respectively. Moreover, the average donations (to any of the charities) was greatest in the NATURE condition, but this was statistically significant only relative to the VIDEO condition. This suggests that a 15 minute nature walk could have motivated not only pro-environmental, but also prosocial behavior more broadly. We observed, however, that the differences between the NATURE and URBAN and VIDEO conditions, respectively, became insignificant when controlling for environmental concern, implying that more environmentally concerned individuals donated more generously and drove this effect. Recent work by (Otto et al., 2021) shows that prosocial propensity, as measured through altruism and honesty-humility, predicts PEB, respectively. Thus, PEB may be also be underpinned by prosociality.

Participants in all treatments performed better on the Digit Span Backwards (DSB) Test–one of our measures of attention restoration–after the 15-minute interventions, suggesting that a break was cognitively restorative. The increase in overall scores in the repeated DSB Test may also be partially attributed to learning effects. We did not find evidence of a greater level of restoration in the NATURE condition compared to other conditions, as measured by the DSB test. However, self-reported levels of restoration (SUBJECTIVE RESTORATION) were significantly higher in the NATURE condition compared to all other conditions.

The discrepancy between the DSB measure and subjective measure of restoration suggests they are capturing different aspects of restoration. We would expect cognitive restoration after a break (Helton and Russell, 2015), which all treatments offered, whereas the self-reported measure may be capturing additional improvements in subjective well-being, which were unique to the nature walk.

We also investigated whether restoration could be a mechanism explaining the relationship between nature and PEB. We found that the effect of nature experience on PEB was mediated by subjective

attention restoration, but the effect became non-significant when controlling for environmental concern and nature identity. This suggests that the mechanism of attention restoration was driven by more environmentally concerned and connected individuals.

An unexpected finding was the relatively poor performance of the nature video, in terms of both restoration and PEB. The two lab treatments (BREAK and VIDEO) provided the least restoration, as indicated in the self-reported measure of attention restoration. The URBAN and NATURE conditions were both significantly more restorative than the VIDEO condition, suggesting that the act of walking outside was beneficial compared to remaining seated in the lab. Previous work by Pilotti et al. (2015) shows some evidence for restoration when comparing a 15-minute video of a nature and an urban scene, but does not include a further comparison to an outdoor experience. The findings of the present study suggest that videos may have more limited restorative potential relative to other alternative activities.

If videos are to be employed as a means of simulating nature exposure, care should be taken in the selection of the specific content. Some participants reported feeling bored watching the video (captured in an optional study feedback question), implying that for the 15-minute duration, the selected video might have been too monotone. This is in line with work by Moreno et al. (2018), who developed the Calm Spot app for classroom usage, which displays a 2-minute nature video for replenishing children's focused engagement in schools. Authors note that in the app's development they included certain features to support engagement, such as display of multiple angles, changing shots, and toggling between close-ups and wide-angle views. The selected video for the present study was a single point-of-view, thus, it is possible that a more varied scene or a shorter video might have been more effective, but this would have to be investigated further.

Aside from being a WEIRD[15] (Henrich et al., 2010) sample, we consider the participants in this study to be particularly close to nature, which may have influenced the results. Reported nature visitation per week was high, with 57% of participants reporting spending 10 or more hours outside per week on average, and nearly half the subjects reported growing up in rural areas. Innsbruck itself is located at the foot of the Nordkette mountains, within the Austrian Alps. As an alpine city, it attracts many active and mountain-sport oriented students, implying an inherent self-selection bias within the student body. Independent of assigned condition, the conservation organization received significantly higher donations on average than the other charitable organizations, demonstrating a preference of cause among the study participants.

Despite evaluating the park chosen for the nature walk favorably, some students in our pilot (data was not included in present analyses) provided informal feedback that they did not consider this to be "truly" natural, as it is a maintained urban park. It is perhaps the juxtaposition to the proximity of remote nature in the high Alps that makes this park appear more urban and less "natural". It is possible that 15 minutes in a more remote environment could have elicited different responses. Similarly, the same study conducted in a more urban environment, or an area with less contrasting

[15] Western, Educated, Industrialized, Rich, and Democratic.

wild nature in close proximity, may also yield different results. Indeed, work by Davis and Gatersleben (2014) shows that whether a wild or manicured natural environment was perceived as more positively or negatively was influenced by the level of nature-connectedness of the visitors. Given the context, we suspect that findings in our setting and with our sample may be a lower-bound estimate and future research could explore differences in study setting by varying the degree of "natural" or wild environments and participant's subjective perception thereof.

Another possible limitation of the study is the relatively short duration of the intervention. In a recent study by Sudimac et al. (2022), which investigates effects of natural and urban environments on stress-related brain mechanisms, participants were exposed to the respective environments for 60 minutes. It is possible that a 15-minute nature experience was insufficient to trigger a sufficiently large restorative effect. It would be interesting to increase and/or vary the duration of the intervention in future studies.

Despite considerable correlational evidence for a connection between nature experiences and PEB, evidence from a randomized controlled trial, which measures observed behavior, rather than self-reported behavior, is limited. The present study helps fill this gap in the literature by analysing the effects of a randomly assigned nature walk, a nature video, an urban walk, or taking a break, on donations to a conservation charity. We found some causal evidence that experiencing nature can lead to greater pro-environmental behavior compared to watching a nature video. Further research is needed to test these findings in different natural environments and within different geographic and population contexts. In light of the growing threat to biodiversity we face today, increasing nature experiences could be an important avenue, not only for increased health and well-being, but also for behavior-change.

CRediT authorship contribution statement

Sarah Lynn Flecke: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review and editing
Rene Schwaiger: Methodology, Software, Formal analysis, Investigation, Writing – original draft, Writing – review and editing
Jürgen Huber: Methodology, Writing – review and editing, Funding acquisition
Michael Kirchler: Methodology, Writing – review and editing, Funding acquisition

Acknowledgements

We thank conference participants of the 2023 International Conference on Environmental Psychology in Aarhus, Denmark, the 6th Workshop on Experimental Economics for the Environment in Innsbruck, Austria, and the Innsbruck Winter School on Credence Goods, Incentives and Behavior 2022, as well as Esther Blanco, Elisabeth Gsottbauer, Pranjal Mehta, and Mathew White for valuable comments on earlier versions of this study. We also thank Hannes Tautschnig for his excellent assistance in data collection.

This project was ethically approved by the Internal Review Board of the University of Innsbruck and was funded by the Austrian Science Fund (FWF), SFB F63.

Declarations of interest: none

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Appendices

for Online Publication

Nature Experiences and Pro-Environmental Behavior: Evidence from a Randomized Controlled Trial

– Working Paper –

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A. Additional Tables and Figures

Table A1: Summary Statistics. Pre- and Post-DSB scores refer to the performance on the Digit Span Backwards test conducted before and after the intervention, respectively. Delta DSB is the difference between the pre- and post-DSB measures and serves as a measure of attention restoration. Subjective restoration is captured on a 1-5 Likert scale. Responses to items in the EID and NEP scales have been averaged, with negative statements reverse-coded. Concern for the environment indicates average responses to concern for global climate change mitigation and biodiversity conservation, both captured on a 1-5 Likert scale. Weather condition was recorded each experimental session by the experimenters, with 1 indicating inclement weather, and 5 indicating clear skies and low winds. Pleasantness of weather was reported by participants in the outdoor conditions, on a 1-5 Likert scale.

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
Participants per Condition	542						
NATURE	138	25.461%					
URBAN	139	25.646%					
VIDEO	133	24.539%					
BREAK	132	24.354%					
Age in Years	542	22.478	3.0556	18.000	20.000	24.000	43.000
Gender	542						
FEMALE	345	63.653%					
MALE	197	36.347%					
Hrs spent outside	542						
$0 - 4$	54	9.963%					
$5 - 9$	181	33.395%					
$10 - 14$	193	35.609%					
$15 - 20$	83	15.314%					
> 20	31	5.720%					
Years in Innsbruck	542	4.090	5.923	0.000	1.000	4.000	32.000
Upbringing	542						
LARGE CITY	56	10.332%					
SMALL CITY	135	24.908%					
MIXED RURAL & URBAN	88	16.236%					
RURAL	263	48.524%					
Donation to nature conservation charity	542	2.451	2.644	0.000	0.000	4.000	10.000
Donation to social welfare charity	542	2.140	2.517	0.000	0.000	3.475	10.00
Donation to art/culture charity	542	1.255	1.938	0.000	0.000	2.000	10.000
Pre-DSB score	541	42.018	21.018	0.000	25.000	56.000	126.000
Post-DSB score	540	53.039	23.447	0.000	36.000	70.000	126.000
Delta DSB Score	540	10.954	20.832	-57.000	-1.000	24.000	92.000
Subjective restoration	542	3.375	1.052	1.000	3.000	4.000	5.000
Environmental Identity Scale (EID)	542	4.228	0.449	2.357	4.000	4.571	5.000
Concern for environment	542	4.513	0.677	1.000	4.000	5.000	5.000
New Environmental Paradigm (NEP)	542	3.749	0.422	2.067	3.483	4.000	4.933
Weather condition	542	3.699	1.046	2.000	3.000	5.000	5.000
Pleasantness of weather	277	4.412	0.883	1.000	4.000	5.000	5.000

Table A2: Percent of participants who donated to the respective charity by condition.

	Conservation	Social	Art / Culture
BREAK	72.730%	61.360%	46.210%
VIDEO	70.680%	69.170%	55.640%
URBAN	66.190%	56.120%	38.130%
NATURE	74.640%	76.090%	61.590%

Table A3: Average donations in euros to the respective charity by condition.

	Conservation	Social	Art / Culture
BREAK	EUR 2.383	EUR 1.934	EUR 1.227
VIDEO	EUR 2.079	EUR 2.053	EUR 1.165
URBAN	EUR 2.382	EUR 2.045	EUR 1.129
NATURE	EUR 2.945	EUR 2.515	EUR 1.493

Table A4: Overall donation behavior across conditions including donations to all three charities (Conservation, Social, and Art / Culture)

	BREAK	NATURE	URBAN	VIDEO
Average donation (EUR)	1.848	2.318	1.852	1.766
Portion of participants who donated	74.240%	80.450%	69.060%	80.450%

Table A5: Manipulation Check: Post-Intervention Attention Restoration. Two-sided paired sample t-test of pre- vs post-intervention Digit Span Backwards test scores by condition. *$p < 0.05$, **$p < 0.005$.

								95% Conf. Bounds	
Condition	N	Mean diff	DF	t-stat.	Cohen's d	p	Signif.	Lower	Upper
BREAK	131	12.496	130	−6.387	0.570	0.000	**	−16.367	−8.625
NATURE	137	11.343	136	−6.248	0.534	0.000	**	−14.933	−7.753
URBAN	139	8.410	138	−5.148	0.437	0.000	**	−11.640	−5.180
VIDEO	133	11.692	132	−6.617	0.574	0.000	**	−15.187	−8.196

Table A6: Attention Restoration Measure 1: Change in Digit Span Backwards Score. Two-sided unpaired sample t-test comparison of the change in pre-intervention vs post-intervention DSB score by condition. *p $<$ 0.05, **p $<$ 0.005.

											95% Conf. Bounds	
Group 1	Group 2	N1	N2	Mean 1	Mean 2	Cohen's d	t-stat.	DF	p	Signif.	Lower	Upper
NATURE	URBAN	138	139	11.343	8.410	0.145	1.202	274	0.230	ns	−1.872	7.738
NATURE	VIDEO	138	133	11.343	11.692	−0.017	−0.138	268	0.891	ns	5.340	4.642
NATURE	BREAK	138	132	11.343	12.496	−0.053	−0.433	266	0.666	ns	−4.096	6.402
URBAN	VIDEO	139	133	8.410	11.692	−0.166	−1.365	270	0.173	ns	−8.014	1.450
URBAN	BREAK	139	132	8.410	12.496	−0.196	−1.610	268	0.109	ns	−0.910	9.082
VIDEO	BREAK	133	132	11.692	12.496	−0.038	−0.305	262	0.760	ns	−4.383	5.992

Table A7: Attention Restoration Measure 2: Self -Reported Restoration. Two-sided unpaired sample t-test comparison of average self-reported restoration by condition. Attention restoration captured on a 5-point Likert scale. *p $<$ 0.05, **p $<$ 0.005.

											95% Conf. Bounds	
Group 1	Group 2	N1	N2	Mean 1	Mean 2	Cohen's d	t-stat.	DF	p	Signif.	Lower	Upper
NATURE	URBAN	138	139	3.717	3.453	0.274	2.276	275	0.024	*	0.036	0.493
NATURE	VIDEO	138	133	3.717	3.038	0.704	5.817	269	0.000	**	0.450	0.910
NATURE	BREAK	138	132	3.717	3.273	0.489	4.030	268	0.000	**	−0.662	−0.227
URBAN	VIDEO	139	133	3.453	3.038	0.368	3.030	270	0.003	**	0.146	0.686
URBAN	BREAK	139	132	3.453	3.273	0.167	1.370	269	0.172	ns	−0.440	0.079
VIDEO	BREAK	133	132	3.038	3.273	−0.217	−1.766	263	0.079	ns	−0.027	0.497

Table A8: Pro-Environmental Behavior (PEB) Measure 1: Portion of Donations to Conservation Charity. Two-sided unpaired sample z-test comparison of the portion of non-zero donations to the nature conservation charity by condition.. *p $<$ 0.05, **p $<$ 0.005.

										95% Conf. Bounds	
Group 1	Group 2	N1	N2	Mean 1	Mean 2	Cohen's h	z-stat.	p	Signif.	Lower	Upper
NATURE	URBAN	138	139	0.746	0.662	0.186	1.540	0.123	ns	−0.022	0.192
NATURE	VIDEO	138	133	0.706	0.707	0.089	0.730	0.464	ns	−0.146	0.066
NATURE	BREAK	138	132	0.746	0.727	0.043	0.360	0.721	ns	−0.124	0.086
URBAN	VIDEO	139	133	0.662	0.707	0.100	−0.800	0.426	ns	−0.065	0.155
URBAN	BREAK	139	132	0.662	0.727	0.143	−1.170	0.243	ns	−0.044	0.175
VIDEO	BREAK	133	132	0.707	0.727	0.050	0.370	0.711	ns	−0.088	0.129

Table A9: Pro-Environmental Behavior (PEB) Measure 2: Donations to Conservation Charity. Two-sided unpaired sample t-test comparison of average donations in Euros made to the nature conservation charity by condition. *p < 0.05, **p < 0.005.

											95% Conf. Bounds	
Group 1	Group 2	N1	N2	Mean 1	Mean 2	Cohen's d	t-stat.	DF	p	Signif.	Lower	Upper
NATURE	URBAN	138	139	2.945	2.382	0.201	1.670	275	0.095	ns	−0.099	1.225
NATURE	VIDEO	138	133	2.945	2.079	0.337	2.769	269	0.006	*	0.250	1.482
NATURE	BREAK	138	132	2.945	2.383	0.203	1.664	268	0.097	ns	−1.226	0.103
URBAN	VIDEO	139	133	2.382	2.079	0.122	1.004	270	0.316	ns	−0.291	0.897
URBAN	BREAK	139	132	2.382	2.383	−0.000	−0.004	269	0.997	ns	−0.642	0.645
VIDEO	BREAK	133	132	2.079	2.383	−0.124	−1.013	263	0.312	ns	−0.287	0.896

Table A10: Multivariate OLS regression models. The dependent variable is represented by our objective measure of attention restoration (ΔDSB SCORE). Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0-4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level (31 clusters). Post estimation Wald tests show test statistics (Chi^2). $^{*}p < 0.05$, $^{**}p < 0.005$.

	Model (I)	Model (II)	Model (III)
Condition (Reference: BREAK)			
BREAK	1.153	1.168	0.862
	(2.115)	(2.107)	(2.277)
VIDEO	0.349	0.368	0.191
	(2.470)	(2.453)	(2.377)
URBAN	−2.933	−2.919	−2.112
	(1.806)	(1.800)	(1.880)
Environmental Concern			
EVNIRON. CONCERN		0.089	0.219
		(1.166)	(1.512)
Gender (Reference: FEMALE)			
FEMALE			−1.929
			(2.204)
Upbringing (Reference: RURAL)			
MIXED RURAL & URBAN			−0.857
			(2.276)
SMALL CITY			−1.026
			(1.818)
LARGE CITY			−2.971
			(3.031)
Hours in Nature (Reference: $0-4$)			
$5-9$			1.716
			(2.830)
$10-14$			−0.403
			(3.172)
$15-20$			4.594
			(3.823)
>20			5.823
			(3.802)
Other Control Variables			
AGE IN YEARS			0.205
			(0.249)
ENVIRON. IDENTITY SCALE (EID)			−0.412
			(2.421)
SUBJ. WEATHER			0.674
			(0.886)
YEARS IN INNSBRUCK			0.200
			(0.140)
Constant	11.343**	10.928	4.535
	(1.109)	(5.732)	(8.693)
Observations	540	540	540
Prob > F	0.272	0.411	0.056
R^2	0.006	0.006	0.025
Post Estimation Wald-Tests (F):			
VIDEO VS. NATURE	0.080	0.079	0.051
VIDEO VS. URBAN	3.165	3.165	1.199
NATURE VS. URBAN	1.560	1.563	0.669

Table A13: Marginal effects logit regression models with a dummy variable (0/1), where 1 indicates that any non-zero amount was donated to any charity. The dependent variable is a binary dummy of whether participants made a donation. Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0-4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level (31 clusters). Post estimation Wald tests show test statistics (Chi^2). $^*p < 0.05$, $^{**}p < 0.005$.

	Model (I)	Model (II)	Model (III)
Condition (Reference: NATURE)			
BREAK	−0.062	−0.041	−0.028
	(0.051)	(0.051)	(0.054)
VIDEO	0.000	0.027	0.048
	(0.048)	(0.048)	(0.055)
URBAN	−0.114*	−0.093	−0.078
	(0.052)	(0.052)	(0.056)
Environmental Concern			
EVNIRON. CONCERN		0.116**	0.065**
		(0.023)	(0.021)
Gender (Reference: MALE)			
FEMALE			0.142**
			(0.047)
Upbringing (Reference: RURAL)			
MIXED RURAL & URBAN			0.020
			(0.062)
SMALL CITY			−0.001
			(0.047)
LARGE CITY			0.128**
			(0.044)
Hours in Nature (Reference: $0-4$)			
$5-9$			0.085*
			(0.043)
$10-14$			0.081
			(0.066)
$15-20$			0.027
			(0.084)
>20			−0.094
			(0.102)
Other Control Variables			
AGE IN YEARS			−0.012
			(0.006)
ENVIRON. IDENTITY SCALE (EID)			0.116*
			(0.052)
SUBJ. WEATHER			0.006
			(0.018)
YEARS IN INNSBRUCK			−0.004
			(0.003)
Observations	542	542	542
Prob > Chi^2	0.080	0.000	0.000
Pseudo R^2	0.011	0.049	0.122
Post Estimation Wald-Tests (Chi^2):			
BREAK VS. VIDEO	1.465	1.920	2.476
BREAK VS. URBAN	0.898	0.940	0.968
VIDEO VS. URBAN	4.767*	5.670*	6.129*

Table A11: Pairwise multivariate marginal effects logistic regression models on an indicator for donations made to the nature conservation charity. The dependent variable is a binary dummy of whether participants made a donation. Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0 - 4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level. $^{*}p < 0.05$, $^{**}p < 0.005$.

	BREAK VS. VIDEO	BREAK VS. NATURE	BREAK VS. URBAN	VIDEO VS. NATURE	VIDEO VS. URBAN	NATURE VS. URBAN
CONDITION	−0.006	−0.013	−0.079	−0.021	−0.046	−0.027
	(0.049)	(0.038)	(0.055)	(0.051)	(0.058)	(0.044)
Environmental Concern						
EVNIRON. CONCERN	0.059	0.085*	0.077*	0.106*	0.098*	0.117**
	(0.039)	(0.043)	(0.039)	(0.040)	(0.037)	(0.033)
Gender (Reference: MALE)						
FEMALE	0.164*	0.144*	0.150*	0.186*	0.188*	0.180*
	(0.078)	(0.064)	(0.076)	(0.073)	(0.084)	(0.076)
Upbringing (Reference: RURAL)						
MIXED RURAL & URBAN	0.070	−0.024	0.125	−0.019	0.122	0.032
	(0.080)	(0.097)	(0.082)	(0.083)	(0.075)	(0.101)
SMALL CITY	−0.059	−0.107	0.046	−0.083	0.046	0.015
	(0.065)	(0.098)	(0.075)	(0.080)	(0.066)	(0.089)
LARGE CITY	0.165*	0.102	0.231**	−0.009	0.133	0.079
	(0.068)	(0.069)	(0.056)	(0.064)	(0.083)	(0.070)
Hours in Nature (Reference: $0 - 4$)						
$5 - 9$	0.079	0.074	0.093*	0.070	0.088	0.110
	(0.060)	(0.052)	(0.035)	(0.086)	(0.075)	(0.074)
$10 - 14$	0.099	0.085	0.147*	0.051	0.105	0.103
	(0.104)	(0.096)	(0.069)	(0.136)	(0.117)	(0.121)
$15 - 20$	0.113	−0.044	0.065	−0.035	0.087	−0.081
	(0.100)	(0.093)	(0.106)	(0.127)	(0.136)	(0.133)
> 20	−0.133	−0.140	−0.036	−0.111	0.008	0.018
	(0.107)	(0.128)	(0.148)	(0.132)	(0.158)	(0.154)
Other Control Variables						
AGE IN YEARS	0.000	−0.014	−0.012	−0.009	−0.005	−0.023*
	(0.008)	(0.011)	(0.011)	(0.008)	(0.011)	(0.010)
ENVIRON. IDENTITY SCALE (EID)	0.135*	0.114	0.147*	0.067	0.103	0.088
	(0.068)	(0.071)	(0.061)	(0.103)	(0.078)	(0.077)
SUBJ. WEATHER	−0.020	0.004	0.012	0.015	0.017	0.042
	(0.020)	(0.024)	(0.027)	(0.025)	(0.031)	(0.026)
YEARS IN INNSBRUCK	−0.008**	−0.008**	−0.007*	−0.005	−0.004	−0.004
	(0.003)	(0.002)	(0.003)	(0.003)	(0.004)	(0.003)
Observations	265	270	271	271	272	277
Pseudo R^2	0.147	0.130	0.136	0.122	0.122	0.129

Table A12: Pairwise, multivariate marginal effects fractional response regression on the portion of total endowment donated to the nature conservation charity. The dependent variable is represented by the fraction of the endowment of EUR 10 donated to the conservation charity. Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0 - 4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level $^{*}p < 0.05$, $^{**}p < 0.005$.

	BREAK VS. VIDEO	BREAK VS. NATURE	BREAK VS. URBAN	VIDEO VS. NATURE	VIDEO VS. URBAN	NATURE VS. URBAN
CONDITION	−0.030	0.039	0.007	0.063*	0.032	−0.016
	(0.026)	(0.034)	(0.039)	(0.026)	(0.028)	(0.034)
Environmental Concern						
EVNIRON. CONCERN	0.065*	0.084*	0.072*	0.124**	0.092**	0.127**
	(0.031)	(0.038)	(0.028)	(0.028)	(0.019)	(0.023)
Gender (Reference: MALE)						
FEMALE	0.063*	0.094**	0.082	0.075*	0.059	0.098*
	(0.031)	(0.032)	(0.048)	(0.029)	(0.044)	(0.048)
Upbringing (Reference: RURAL)						
MIXED RURAL & URBAN	0.049	0.045	0.006	−0.000	−0.010	−0.033
	(0.037)	(0.044)	(0.036)	(0.044)	(0.033)	(0.031)
SMALL CITY	0.023	0.009	−0.031	0.028	0.006	−0.010
	(0.040)	(0.053)	(0.044)	(0.050)	(0.042)	(0.053)
LARGE CITY	0.099	0.083	0.098	−0.016	0.025	−0.016
	(0.058)	(0.060)	(0.061)	(0.038)	(0.035)	(0.040)
Hours in Nature (Reference: $0 - 4$)						
$5 - 9$	−0.000	−0.028	−0.011	0.038	0.055	0.037
	(0.070)	(0.065)	(0.066)	(0.026)	(0.040)	(0.034)
$10 - 14$	0.015	0.022	−0.026	0.054	0.015	0.024
	(0.060)	(0.079)	(0.057)	(0.057)	(0.039)	(0.060)
$15 - 20$	0.039	−0.067	−0.054	0.008	0.035	−0.080
	(0.071)	(0.089)	(0.072)	(0.071)	(0.052)	(0.069)
> 20	0.030	−0.081	−0.068	0.098	0.103	−0.011
	(0.101)	(0.098)	(0.085)	(0.085)	(0.080)	(0.067)
Other Control Variables						
AGE IN YEARS	0.004	−0.001	0.004	−0.005	−0.000	−0.007
	(0.007)	(0.008)	(0.009)	(0.005)	(0.005)	(0.007)
ENVIRON. IDENTITY SCALE (EID)	0.068	0.104	0.082	0.013	−0.005	0.029
	(0.041)	(0.054)	(0.053)	(0.059)	(0.056)	(0.060)
SUBJ. WEATHER	−0.002	0.003	−0.000	0.014	0.011	0.023
	(0.011)	(0.012)	(0.016)	(0.008)	(0.015)	(0.014)
YEARS IN INNSBRUCK	−0.005	0.003	−0.002	0.001	−0.006	0.003
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Observations	265	270	271	271	272	277
Pseudo R^2	0.041	0.052	0.042	0.047	0.040	0.052

Table A14: Marginal effects fractional regression models with the average fraction of the endowment donated to all three charities. The dependent variable is represented by the fraction of the endowment of EUR 10 donated to the conservation charity. Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0-4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level (31 clusters). Post estimation Wald tests show test statistics (Chi^2). $^{*}p < 0.05$, $^{**}p < 0.005$.

	Model (I)	Model (II)	Model (III)
Condition (Reference: NATURE)			
BREAK	−0.047	−0.036	−0.031
	(0.028)	(0.027)	(0.029)
VIDEO	−0.055*	−0.041	−0.039
	(0.025)	(0.024)	(0.023)
URBAN	−0.047	−0.036	−0.030
	(0.027)	(0.025)	(0.027)
Environmental Concern			
EVNIRON. CONCERN		0.073**	0.060**
		(0.016)	(0.019)
Gender (Reference: MALE)			
FEMALE			0.062**
			(0.022)
Upbringing (Reference: RURAL)			
MIXED RURAL & URBAN			−0.003
			(0.021)
SMALL CITY			0.014
			(0.025)
LARGE CITY			0.017
			(0.031)
Hours in Nature (Reference: $0-4$)			
$5-9$			0.028
			(0.033)
$10-14$			0.041
			(0.035)
$15-20$			0.017
			(0.046)
>20			0.023
			(0.045)
Other Control Variables			
AGE IN YEARS			−0.001
			(0.005)
ENVIRON. IDENTITY SCALE (EID)			0.018
			(0.030)
SUBJ. WEATHER			0.006
			(0.008)
YEARS IN INNSBRUCK			−0.000
			(0.001)
Observations	542	542	542
Prob > Chi^2	0.114	0.000	0.000
Pseudo R^2	0.003	0.015	0.024
Post Estimation Wald-Tests (Chi^2):			
BREAK VS. VIDEO	0.106	0.043	0.114
BREAK VS. URBAN	0.000	0.001	0.003
VIDEO VS. URBAN	0.132	0.036	0.188

Table A15: Marginal effects logistic regression models with a dummy variable (0/1), where 1 indicates that any positive amount was donated across the three charities for each of the four conditions. The conservation charity serves as the reference category. Post estimation Wald tests show test statistics (Chi^2). *p < 0.05, **p < 0.005. Clustered standard errors on the subject level in parentheses.

	BREAK	VIDEO	NATURE	URBAN
Charity (Reference: NATURE CONSERVATION)				
SOCIAL	−0.114**	−0.015	0.014	−0.101**
	(0.032)	(0.034)	(0.027)	(0.033)
ARTS	−0.265**	−0.150**	−0.130**	−0.281**
	(0.040)	(0.043)	(0.038)	(0.040)
Observations	396	399	414	417
Nr. of subjects	132	133	138	139
Prob > Chi^2	0.000	0.001	0.000	0.000
Pseudo R^2	0.037	0.015	0.017	0.040
Post Estimation Wald-Tests (Chi^2):				
SOCIAL VS. ARTS	17.282**	10.877**	20.789**	27.574**

Table A16: Marginal effects fractional regression models with the average fraction of the endowment donated across the three charities for each of the four conditions. The conservation charity serves as the reference category. Post estimation Wald tests show test statistics (Chi^2). *p < 0.05, **p < 0.005. Clustered standard errors on the subject level in parentheses.

	BREAK	VIDEO	NATURE	URBAN
Charity (Reference: NATURE CONSERVATION)				
SOCIAL	−0.045**	−0.003	−0.043**	−0.034*
	(0.011)	(0.016)	(0.015)	(0.017)
ARTS	−0.116**	−0.091**	−0.145**	−0.125**
	(0.015)	(0.016)	(0.017)	(0.018)
Observations	396	399	414	417
Nr. of subjects	132	133	138	139
Prob > Chi^2	0.000	0.000	0.000	0.000
Pseudo R^2	0.016	0.014	0.020	0.020
Post Estimation Wald-Tests (Chi^2):				
SOCIAL VS. ARTS	26.087**	31.088**	54.921**	35.243**

Table A17: Paramed Mediation Analyses (BREAK vs. NATURE) on the absolute amount donated to the conservation charity. To properly account for a potential interaction effect between the exposure variable NATURE and our mediators NEP, SUBJECTIVE RESTORATION, and ΔDSB SCORE, we estimated a controlled direct effect at a level of zero of the respective mediator, as well as a natural direct effect based on the actual level of the mediators in condition BREAK, which served as the reference category. Control variables are EVNIRON. CONCERN and ENVIRON. IDENTITY SCALE (EID). Standard errors in parentheses. $^{*}p < 0.05$, $^{**}p < 0.005$.

	Effect: NATURE → PRO-ENVIRONMENTAL BEHAVIOR (PEB)					
	Mediator: NEP		**Mediator**: ΔDSB SCORE		**Mediator**: SUBJ. ATT. REST.	
	Model (I)	Model (II)	Model (III)	Model (IV)	Model (V)	Model (VI)
CONTROLLED DIRECT EFFECT	2.260	1.964	0.343	0.246	−1.120	−0.453
	(3.222)	(3.175)	(0.387)	(0.376)	(1.413)	(1.387)
NATURAL DIRECT EFFECT	0.505	0.404	0.532	0.371	0.261	0.226
	(0.336)	(0.330)	(0.341)	(0.332)	(0.363)	(0.352)
NATURAL INDIRECT EFFECT	0.057	−0.000	−0.004	−0.002	0.301	0.175
	(0.061)	(0.008)	(0.016)	(0.014)	(0.156)	(0.137)
MARGINAL TOTAL EFFECT	0.562	0.403	0.528	0.368	0.562	0.401
	(0.338)	(0.330)	(0.340)	(0.331)	(0.339)	(0.330)
Observations	270	269	270	269	270	269
Control Variables	No	Yes	No	Yes	No	Yes

Table A18: Paramed Mediation Analyses (URBAN vs. NATURE) on the absolute amount donated to the conservation charity. To properly account for a potential interaction effect between the exposure variable NATURE and our mediators NEP, SUBJECTIVE RESTORATION, and ΔDSB SCORE, we estimated a controlled direct effect at a level of zero of the respective mediator, as well as a natural direct effect based on the actual level of the mediators in condition NATURE, which served as the reference category. Control variables are EVNIRON. CONCERN and ENVIRON. IDENTITY SCALE (EID). Standard errors in parentheses. $^{*}p < 0.05$, $^{**}p < 0.005$.

	Effect: NATURE → PRO-ENVIRONMENTAL BEHAVIOR (PEB)					
	Mediator: NEP		**Mediator**: ΔDSB SCORE		**Mediator**: SUBJ. ATT. REST.	
	Model (I)	Model (II)	Model (III)	Model (IV)	Model (V)	Model (VI)
CONTROLLED DIRECT EFFECT	−3.997	−3.500	−0.576	−0.433	1.905	1.382
	(3.183)	(3.157)	(0.377)	(0.367)	(1.406)	(1.382)
NATURAL DIRECT EFFECT	−0.329	−0.298	−0.525	−0.350	−0.559	−0.384
	(0.337)	(0.331)	(0.340)	(0.333)	(0.344)	(0.335)
NATURAL INDIRECT EFFECT	−0.234*	−0.098	−0.023	−0.024	−0.004	−0.012
	(0.112)	(0.069)	(0.041)	(0.040)	(0.055)	(0.052)
MARGINAL TOTAL EFFECT	−0.563	−0.396	−0.548	−0.374	−0.563	−0.396
	(0.337)	(0.330)	(0.339)	(0.331)	(0.339)	(0.331)
Observations	277	276	277	276	277	276
Control Variables	No	Yes	No	Yes	No	Yes

Table A19: Spearman and Pearson correlation matrices with all measured covariates and participant characteristics in conditions NATURE and VIDEO. The top right matrix reports the results of a Spearman correlation analysis between all variables and the bottom left matrix represents the results of a Pearson correlation analysis between all variables. $^{*}p < 0.05$, $^{**}p < 0.005$.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) DONATION CONSERVATION CHARITY		0.089	0.152*	−0.051	0.126*	0.243**	0.243**	0.024	−0.050	0.235**	0.027	0.041	−0.120*
(2) CONDITION	0.095		0.026	−0.022	0.227**	0.114	0.079	0.056	0.010	0.010	0.003	−0.058	0.006
(3) NEP	0.185**	0.078		0.035	0.098	0.436**	0.187**	−0.127*	0.037	0.410**	0.124*	−0.068	0.051
(4) ΔDSB SCORE	−0.037	−0.027	0.033		−0.086	−0.007	−0.017	−0.040	0.091	−0.091	−0.006	0.001	0.010
(5) SUBJECTIVE RESTORATION	0.150*	0.237**	0.106	−0.061		0.127*	0.006	−0.131*	−0.015	0.172**	0.150*	−0.033	−0.034
(6) EVNIRON. CONCERN	0.249**	0.132*	0.511**	0.004	0.137*		0.100	−0.023	0.098	0.403**	0.083	0.062	0.048
(7) FEMALE	0.211**	0.079	0.223**	−0.027	0.014	0.129*		−0.083	−0.055	0.177**	0.038	0.046	−0.037
(8) UPBRINGING	0.042	0.052	−0.127*	−0.037	−0.101	−0.016	−0.076		0.013	−0.162*	−0.136*	−0.019	−0.063
(9) AGE IN YEARS	0.012	−0.017	0.024	0.018	−0.008	0.026	−0.096	0.034		0.162*	−0.090	0.094	0.525**
(10) ENVIRON. IDENTITY SCALE (EID)	0.230**	0.040	0.464**	−0.058	0.177**	0.433**	0.205**	−0.169*	0.113		0.340**	−0.002	−0.006
(11) HOURS IN NATURE (PER WEEK)	0.015	0.006	0.148*	0.027	0.122*	0.126*	0.036	−0.138*	−0.087	0.342**		0.080	−0.078
(12) SUBJ. WEATHER	0.035	−0.068	−0.053	0.036	−0.026	0.083	0.040	0.013	0.036	0.038	0.064		0.062
(13) YEARS IN INNSBRUCK	0.073	−0.016	0.026	0.021	0.029	0.033	0.037	−0.063	0.280**	−0.025	−0.066	0.067	

Table A20: Paramed Mediation Analyses (VIDEO vs. NATURE) on the absolute amount donated to the conservation charity. To properly account for a potential interaction effect between the exposure variable NATURE and our mediator NEP, we estimated a controlled direct effect at a level of zero of the respective mediator, as well as a natural direct effect based on the actual level of the mediators in condition VIDEO, which served as the reference category. Standard errors in parentheses. $^{*}p < 0.05$, $^{**}p < 0.005$.

	Effect: NATURE → PRO-ENVIRONMENTAL BEHAVIOR (PEB)	
	Mediator: NEP	
	Model (I)	Model (II)
CONTROLLED DIRECT EFFECT	0.299	−1.909
	(9.137)	(9.044)
NATURAL DIRECT EFFECT	2.197*	1.830
	(1.051)	(0.976)
NATURAL INDIRECT EFFECT	0.401	0.113
	(0.505)	(0.283)
MARGINAL TOTAL EFFECT	2.598*	1.943*
	(0.942)	(0.928)
Observations	271	270
Control Variables	No	Yes

Table A21: Multivariate marginal effects fractional response regression on the portion of total endowment donated to the nature conservation charity, with exclusions. 26 individuals were removed from the sample, who did not attain at least 20% of correct responses in the mental math section, in accordance with the pre-registered criteria. The dependent variable is represented by the fraction of the endowment of EUR 10 donated to the conservation charity. Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0-4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level (31 clusters). Post estimation Wald tests show test statistics (Chi^2). $^{*}p < 0.05$, $^{**}p < 0.005$.

	Model (I)	Model (II)	Model (III)
Condition (Reference: NATURE)			
BREAK	−0.059	−0.040	−0.039
	(0.031)	(0.033)	(0.029)
VIDEO	−0.085**	−0.062*	−0.061*
	(0.026)	(0.030)	(0.025)
URBAN	−0.063	−0.048	−0.037
	(0.035)	(0.032)	(0.034)
Environmental Concern			
EVNIRON. CONCERN		0.128**	0.103**
		(0.019)	(0.023)
Gender (Reference: MALE)			
FEMALE			0.073**
			(0.026)
Upbringing (Reference: RURAL)			
MIXED RURAL & URBAN			0.014
			(0.027)
SMALL CITY			0.006
			(0.034)
LARGE CITY			0.054
			(0.039)
Hours in Nature (Reference: $0-4$)			
$5-9$			0.009
			(0.043)
$10-14$			0.014
			(0.048)
$15-20$			−0.028
			(0.057)
>20			0.003
			(0.067)
Other Control Variables			
AGE IN YEARS			−0.003
			(0.006)
ENVIRON. IDENTITY SCALE (EID)			0.058
			(0.038)
SUBJ. WEATHER			0.009
			(0.009)
YEARS IN INNSBRUCK			0.000
			(0.002)
Observations	516	516	516
Prob > Chi^2	0.009	0.000	0.000
Pseudo R^2	0.005	0.032	0.044
Post Estimation Wald-Tests (Chi^2):			
BREAK VS. VIDEO	0.952	0.545	0.591
BREAK VS. URBAN	0.014	0.060	0.003
VIDEO VS. URBAN	0.500	0.243	0.557

Table A22: Multivariate marginal effects logistic regression models on an indicator for donations made to the nature conservation charity, with exclusions. 26 individuals were removed from the sample, who did not attain at least 20% of correct responses in the mental math section, in accordance with the pre-registered criteria. The dependent variable is a binary dummy of whether participants made a donation. Dummy variables BREAK, VIDEO, and URBAN denote participants' allocation to conditions, using NATURE as the reference. EVNIRON. CONCERN averages participant responses to global climate change and biodiversity conservation concerns. Gender is encoded by the FEMALE dummy variable (1 for females, 0 for males). Categories SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture participants' upbringing environments, using RURAL as the reference. HOURS IN NATURE (PER WEEK) quantifies weekly hours participants spend in nature, with $0-4$ as the reference. AGE IN YEARS, ENVIRON. IDENTITY SCALE (EID), YEARS IN INNSBRUCK, and SUBJ. WEATHER denote participant age, nature identity scale average, years residing in Innsbruck, and per-session weather assessments by the researchers respectively. We use cluster-robust standard errors at the session level (31 clusters). Post estimation Wald tests show test statistics (Chi^2). $^{*}p < 0.05$, $^{**}p < 0.005$.

	Model (I)	Model (II)	Model (III)
Condition (Reference: NATURE)			
BREAK	−0.013	0.016	0.023
	(0.055)	(0.054)	(0.045)
VIDEO	−0.032	0.004	0.020
	(0.056)	(0.055)	(0.053)
URBAN	−0.073	−0.047	−0.027
	(0.057)	(0.056)	(0.055)
Environmental Concern			
EVNIRON. CONCERN		0.152**	0.090**
		(0.025)	(0.026)
Gender (Reference: MALE)			
FEMALE			0.164**
			(0.049)
Upbringing (Reference: RURAL)			
MIXED RURAL & URBAN			0.056
			(0.066)
SMALL CITY			−0.017
			(0.056)
LARGE CITY			0.118*
			(0.052)
Hours in Nature (Reference: $0-4$)			
$5-9$			0.085
			(0.045)
$10-14$			0.087
			(0.081)
$15-20$			0.012
			(0.089)
>20			−0.084
			(0.102)
Other Control Variables			
AGE IN YEARS			−0.010
			(0.007)
ENVIRON. IDENTITY SCALE (EID)			0.128*
			(0.054)
SUBJ. WEATHER			0.010
			(0.020)
YEARS IN INNSBRUCK			−0.006*
			(0.002)
Observations	516	516	516
Prob > Chi^2	0.591	0.000	0.000
Pseudo R^2	0.003	0.053	0.124
Post Estimation Wald-Tests (Chi^2):			
BREAK VS. VIDEO	0.113	0.045	0.002
BREAK VS. URBAN	1.111	1.297	0.763
VIDEO VS. URBAN	0.516	0.864	0.590

B. Description of Variables Included in Regressions.

- EVNIRON. CONCERN: the average of participant responses to their reported concern about global climate change and biodiversity conservation respectively. Each reported on Likert scale from 1-5
- Gender is represented by the FEMALE dummy variable , with 1 coded for females, 0 for males
- SMALL CITY, MIXED RURAL & URBAN, and LARGE CITY capture the environments in which participants grew up, with RURAL as the reference category
- HOURS IN NATURE (PER WEEK): quantifies the hours spent outside in nature in a typical week, with $0 - 4$ hours as the reference category
- AGE IN YEARS: participant age
- ENVIRON. IDENTITY SCALE (EID): the average score of all items of the Nature Identity Scale, with negative statements reverse-coded
- YEARS IN INNSBRUCK: years residing in Innsbruck (incl. surroundings) at time of study
- SUBJ. WEATHER: a per-session assessment of the weather condition, which was recorded at the start of each experimental session by the researchers on a scale of 1-5, with 5 presenting near-ideal, sunny and pleasant conditions.

C. Instructions of the Experiment and Surveys

C.1. Part 1 General

Disclaimer

Dear participant,

Welcome to today's experiment! Thank you for agreeing to participate in this study.

As part of this experiment, we will ask you to fill out questionnaires and make decisions. You will be financially compensated for your time. Please read the experiment instructions carefully. All statements in the instructions are true. It is essential for the experiment that you are not distracted. That's why we've asked you to surrender your phone for the duration of the study. Also, we request that you do not talk to each other during the study.

We ask that you complete all sections carefully and answer honestly. Information about your final compensation will be provided at the end of the experiment.

By clicking on the "Participate" button, you confirm that you participate voluntarily and accept, surrendering your mobile phone for the duration of the study. Also, you agree that your responses, including basic demographic information, will be stored, but no identifiable personal data will be collected from you. All data will be anonymized and only used for scientific research purposes. Your data will not be shared with third parties.

If you have any questions during the experiment, please raise your hand – the experiment supervisor will answer your questions privately. We kindly ask you not to use any further tools from now on.

Participate

Your IBAN

Please enter your valid IBAN here. Your IBAN starts with a country code, e.g. "AT", "DE", or "IT".

Please repeat the input of your IBAN here.

Next

How important are the following topics to you?

Protection of EU external borders.

Not at all important — Very important

Improving social welfare.

Not at all important — Very important

Ethics in artificial intelligence (AI).

Not at all important — Very important

Ending the COVID-19 pandemic.

Not at all important — Very important

Ending discrimination.

Not at all important — Very important

Resolution of the Russia-Ukraine conflict.

Not at all important — Very important

Reducing political polarization.

Not at all important — Very important

Environmental protection and biodiversity conservation.

Not at all important — Very important

Prevention of global climate change.

Not at all important — Very important

Reduction of economic inequality.

Not at all important — Very important

Next

Instructions for Task 1

On the next page, we will ask you to complete a mathematical task. You will try to solve mathematical equations in your head as best you can. You are not allowed to take notes or use a calculator.

When you click the "Continue" button, the task begins immediately. You have exactly 2 minutes for the task and will be automatically redirected to the next page after this time.

Next

Task 1

Time left to complete this page: **1:31**

Please solve the following mathematical equations as best you can in your head:

7 + 8 =	
13 + 28 =	
67 - 32 =	
74 + 19 =	
35 + 46 =	
63 - 47 =	
57 + 81 =	
23 - 17 =	
24 + 78 =	
13 + 89 =	
91 - 54 =	
26 + 17 =	
76 - 38 =	
45 + 36 =	
98 + 55 =	

Next

Instructions Task 2

On the next page, we will ask you to solve another task. This time you should form as many new words as possible from the letters of a given word in a short time. You do not have to use all the letters, and you can vary the order of the letters as you like, but you may only use letters that are present in the given word. You are not allowed to use the same letter more than once. You are not limited to certain types of words and can ignore upper and lower case.

Example: **"Faces"**
Possible new words: Ace, aces, safe...

When you click the "Continue" button, the task will start immediately and the given word will be displayed. You have exactly 2 minutes for the task and will be automatically redirected to the next page after this time has elapsed.

Next

Task 2

Time left to complete this page: **1:53**

Now please think about what words can be formed from the following word „**Questionnaire**" and write down your ideas in the given text boxes. You have 2 minutes.

Next

Instructions Task 3

On the next page, we will ask you to complete another task. You will be shown a multi-digit number in the middle of the screen inside a **green box** (see figure below). Its digits will **appear on the screen one by one at intervals of one second** and then disappear.

Your task is to **remember the entire number and enter it in reverse order** into the text field provided below the green box and confirm by clicking on '*Confirm Answer*'. You cannot use the keyboard for this, but must use the touchscreen with the green input fields (see figure below).

Example: 6 8 2
Correct answer: 2 8 6

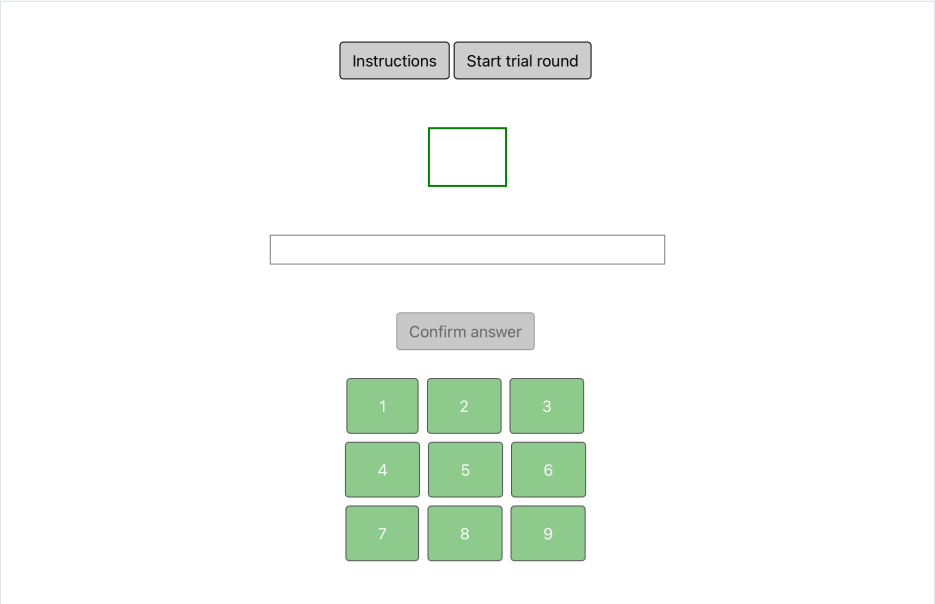
When you click on the "Next" button, the task will not start immediately. You must start each round on your own. Initially, you have a trial round with a three-digit number (click on '*Start trial round*'), where short feedback on your input and the correct solution is displayed. Afterwards you can start the actual task (click on '*Start task*'). From this point on, you will no longer receive any feedback on whether your inputs were correct or incorrect. There are a total of **fourteen rounds plus the trial round at the beginning. There is no time limit**.

The task also begins in the first round with a three-digit number. After every second round the level of difficulty automatically increases by one digit when you start the next round (click on '*Start next round*'). From the third round on, a four-digit number will therefore be displayed, from the fifth round a five-digit number and so on. The subsequent rounds follow the same pattern. In the last two rounds, a nine-digit number will eventually be displayed. **You only have one attempt in each round** to correctly enter the digits via the input fields. Please enter **carefully digit by digit**, because it is **not possible** to **delete** a digit already entered into the field.

Please focus completely on the task and only click on '*Start task*' or '*Start next round*' in each round when you are ready. You can view these instructions again at the beginning and between rounds by clicking on the '*Instructions*' button.

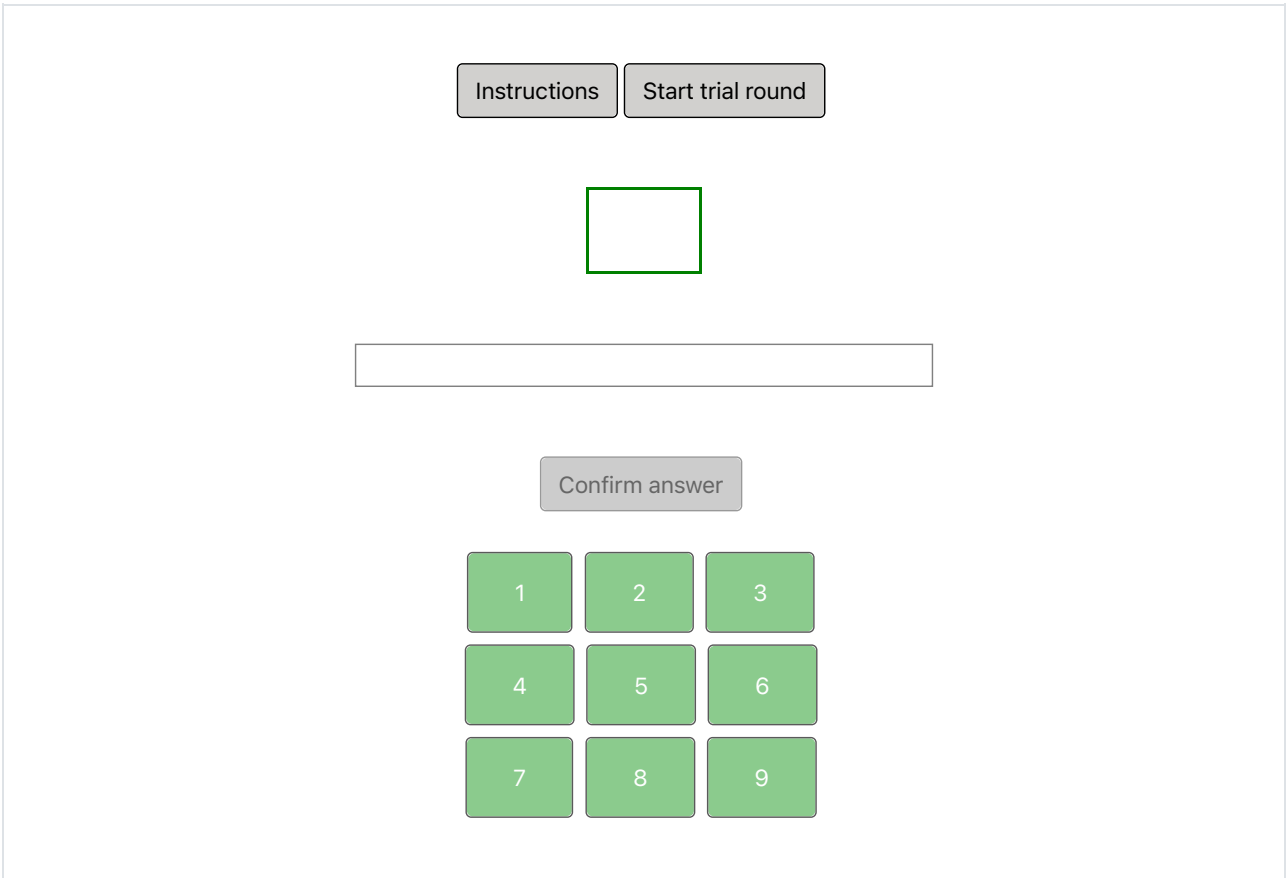
Example of the task screen:

Task 3



Next

Task 3



C.2. Part 2 Intervention: Break

Instructions Part 2

Thank you! You have now completed the first part of the study.

For the second part of the experiment, we ask you now to take a break on the next page. Please stay seated at your place and do not speak to your neighbors. It is **not allowed** to surf the internet or to keep yourself busy with the computer in any other way. The "Next" button will appear automatically after 15 minutes.

○ **I have read and understood the instructions**

Please answer the following questions

How restored do you feel after the break?

○ ○ ○ ○ ○

Not at all restored Very restored

Next

C.3. Part 2 Intervention: Video

Instructions Part 2

Thank you! You have now completed the first part of the study.

For the second part of the experiment, we now ask you to watch a video on the next page. Please use your headphones for this. **Click on the red Youtube button in the middle of the screen to start the video.** The duration of the video is 15 minutes (starts at minute 11:00 and ends at minute 26:00). Please do not change the video segment. **You will be automatically redirected to the next page after the video ends.** Please remove your headphones afterward for the rest of the experiment.

○ **I have read and understood the instructions**

Please answer the following questions

How restored do you feel after the video?

○ ○ ○ ○ ○

Not at all restored Very restored

Next

C.4. Part 2 Intervention: Nature

Instructions Part 2

Thank you! You have now completed the first part of the study.

For the second part of the experiment, we ask you to take a walk through the **Hofgarten**.

The procedure is as follows: Leave your seat individually and quietly, and take a **handout** from the pile at the entrance of the EconLab.

Go to the **main exit** of the SOWI. From there, please go to the Hofgarten and walk around it for about **15 minutes**. This is equivalent to a complete round through the **Hofgarten** on the outermost path.

Please stay **within the park walls**. The walk leads past the pond, along the northern park wall, and down at the rock garden.

For your orientation, we have included a map of the park with the route and some landmarks that you will pass on your walk.

After your walk, go to the **pavilion** in the middle of the Hofgarten, where an assistant will check you off the **list**. Afterwards, go back to the **EconLab to your seat**. At the computer, you will complete the final part of the experiment. All instructions are also printed on your handout. Please put the handout back on the pile at the entrance of the EconLab after your return.

It is important that you perform this activity **alone**. Please do not go in a group and do not talk to each other or to other people you might meet on the way. Please leave handbags or backpacks here so that you can walk comfortably and unencumbered. The lab will be supervised during your absence; your personal belongings are secure.

Please take **your seat ticket** with you and make sure that you sit in the same place upon your return. Otherwise, you lose your compensation for the experiment.

○ **I have read and understood the instructions**

C.5. Handout Nature

Please exit the Social Sciences Faculty (SOWI) via the **main entrance**.

From there, stroll through the "Hofgarten" park for approximately **15 minutes**. It should take you roughly that long to complete a full circuit of the park along the outermost path.

Please remain **within the park walls**. The walk will take you past the pond, along the northern park wall, and down by the rock garden.

For your reference and orientation, we have included a map of the park showing the route as well as some landmarks you will pass along the way.

After your walk, proceed to the **pavilion** in the center of the park, where an assistant will **check you off a list**. Afterwards, please **return to the lab**. You will complete the final part of the experiment on the computer in the lab.

It is important that you complete this activity **alone**. Please do not go in a group and do not talk to each other or anyone else you might meet along the way.

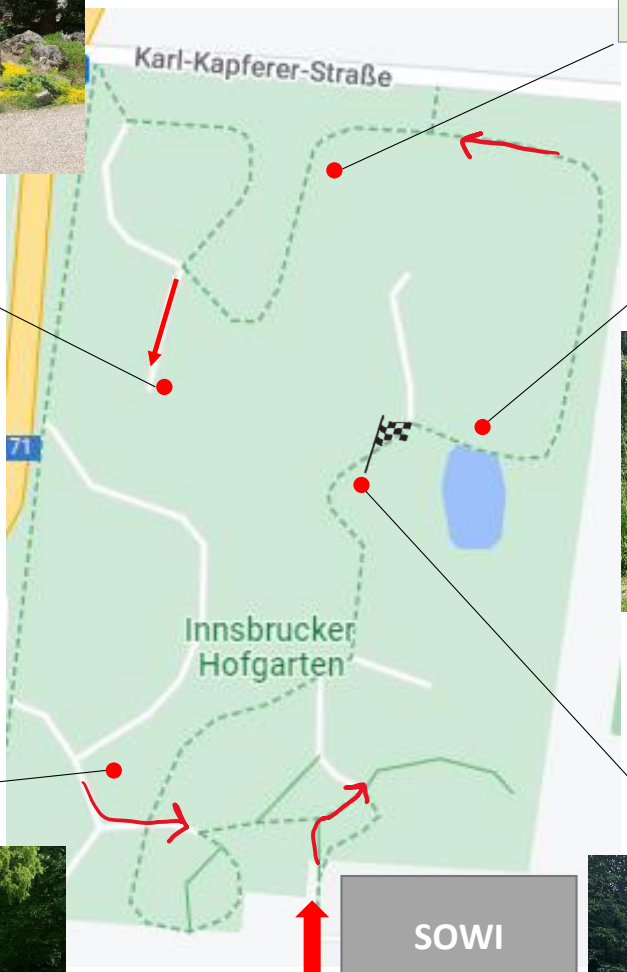
Path from the SOWI to the Hofgarten

Northern Orientation

Detailed map
of the Hofgarten

Palm trees

Stone garden



Pond

Flower
Yin/Yang

Pavillon

SOWI

Entrance via
park gate

Route

Places of interest
along the route

Assistant
meeting point

Please answer the following questions

How restored do you feel after your walk?

Not at all restored — Very restored

How challenging did you find the navigation of the route (from SOWI to the meeting point and back)?

Not challenging at all — Very challenging

How did you find the weather conditions during your walk?

Very unpleasant — Very pleasant

Next

C.6. Part 2 Intervention: Urban

Instructions Part 2

Thank you! You have now completed the first part of the study.

For the second part of the experiment, we ask you to take a walk through the **city**.

The procedure is as follows: Leave your seat quietly and individually and take a **handout** from the pile at the entrance of the EconLab.

Go to the **main exit** of the SOWI. From there, take a walk in the city for about **15 minutes**. We have marked a tour of the **main train station** on this map.

Please stay on the **marked route**. The tour leads over Sillgasse and Museumsstraße to the main train station, and back to SOWI via Meinhardstraße.

For your orientation, we have included a map showing your route and some landmarks you will pass during your walk.

Once you arrive at the main station, an assistant will **check you off the list** and refer you to Brixner Straße. Then, **return to EconLab on your seat via the marked route**. At the PC, you will complete the last part of the experiment. All instructions are also printed on your handout. Please put the handout back on the pile at the entrance of EconLab after your return.

It is important that you **carry out this activity alone**. Please do not go in a group and do not talk to each other or to other people you might meet on the way. Please leave handbags or backpacks here so that you can go comfortably and unencumbered. The lab will be supervised during your absence; your personal belongings are secure.

Please take **your seat card with you** and make sure that you sit in the same place as now after your return. Otherwise, you will lose your compensation for the experiment.

○ **I have read and understood the instructions**

C.7. Handout Urban

Please exit the Social Sciences Faculty (SOWI) via the **main entrance**.

From there, stroll through the city for approximately **15 minutes**. We have marked a circular route via the central train station (HBF) on this map for your convenience.

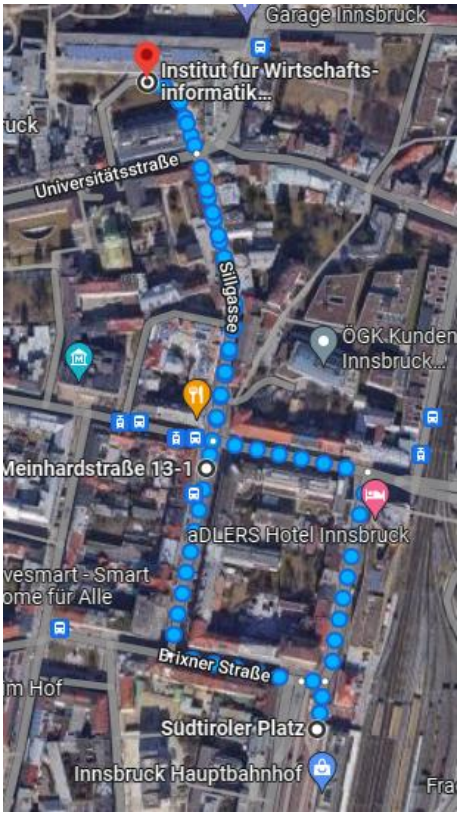
Please remain on the marked route. The walk takes you via the Sillgasse and Museumsstraße to the central train station, and back to the SOWI via the Meinhardstraße.

For your reference and orientation, we have included a map showing the route as well as some landmarks you will pass along the way.

When you arrive at the central station, an assistant will **check you off a list** and direct you to Brixner Straße. Please return to the lab via the marked route. You will complete the final part of the experiment on the computer in the lab.

It is important that you complete this activity **alone**. Please do not go in a group and do not talk to each other or anyone else you might meet along the way.

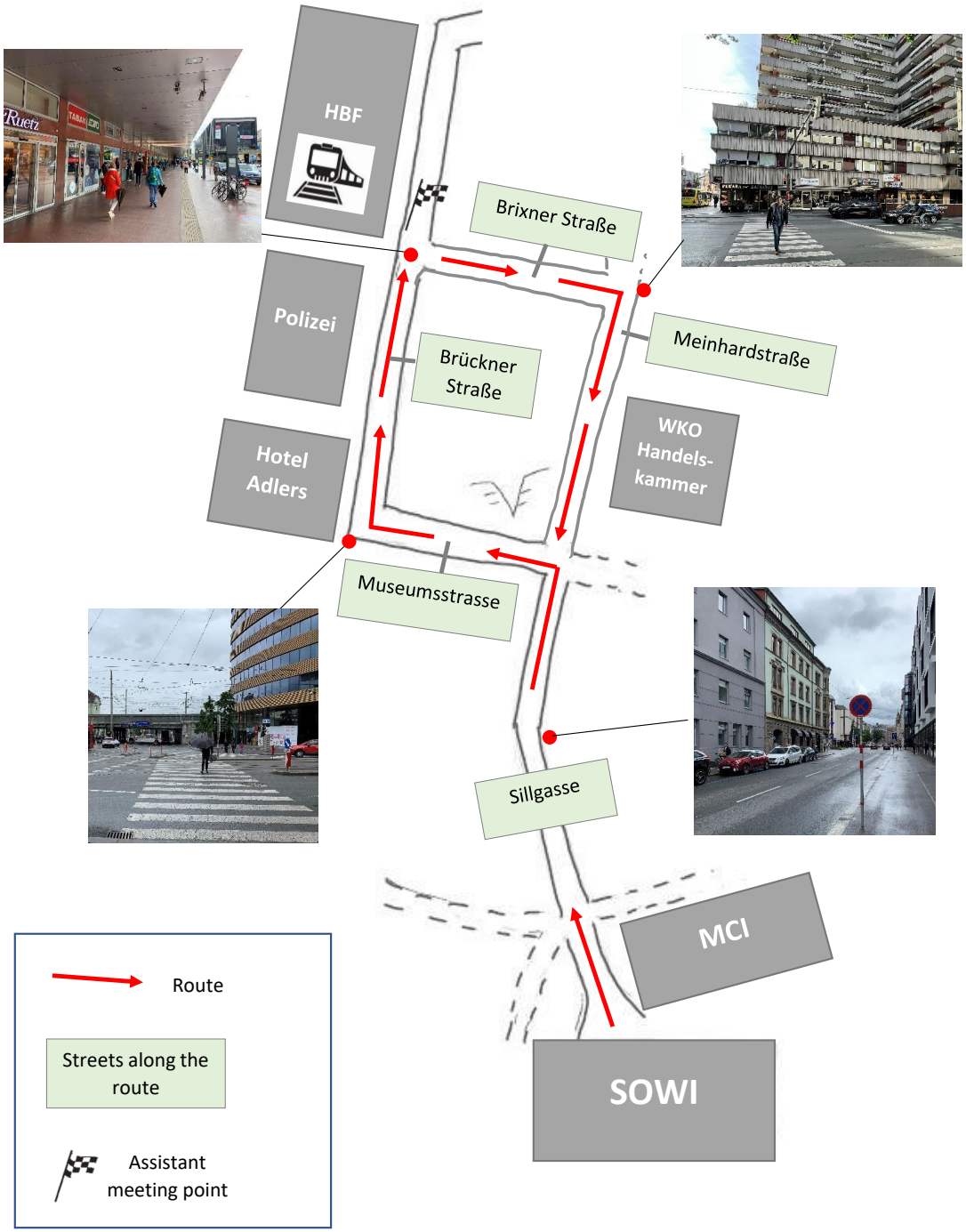
Circular route from the SOWI via the central train station



Northern Orientation

1

Detailed map of the route (navigation view)



Please answer the following questions

How restored do you feel after your walk?

Not at all restored — Very restored

How challenging did you find the navigation of the route (from SOWI to the meeting point and back)?

Not challenging at all — Very challenging

How did you find the weather conditions during your walk?

Very unpleasant — Very pleasant

Next

C.8. Part 3 General

Part 3

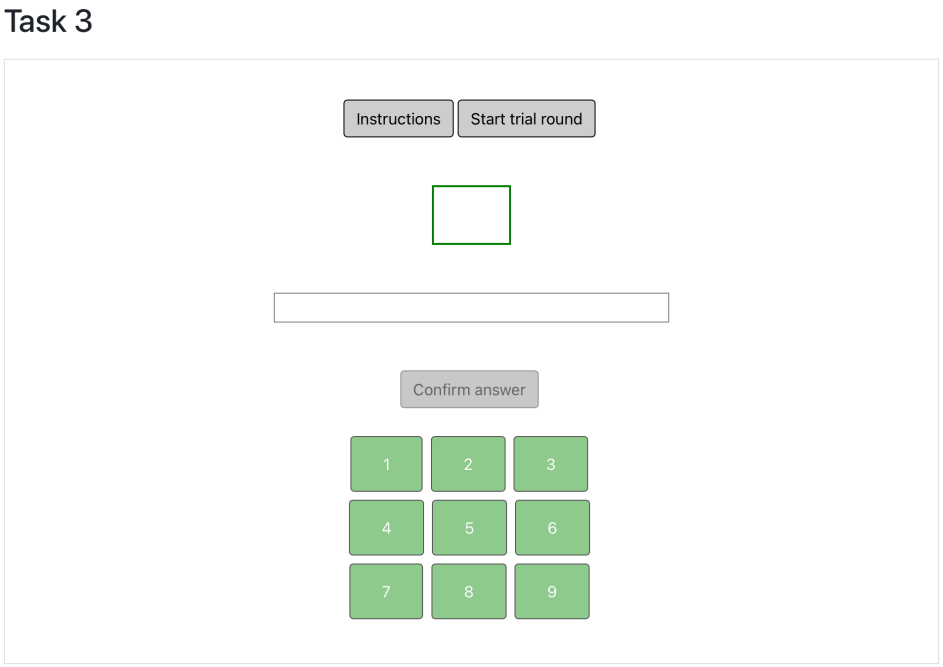
In this third and final part of the study, we would like to ask you to complete two tasks, and then fill out a short survey. This should only take a few minutes.

Next

Repeat Task 3

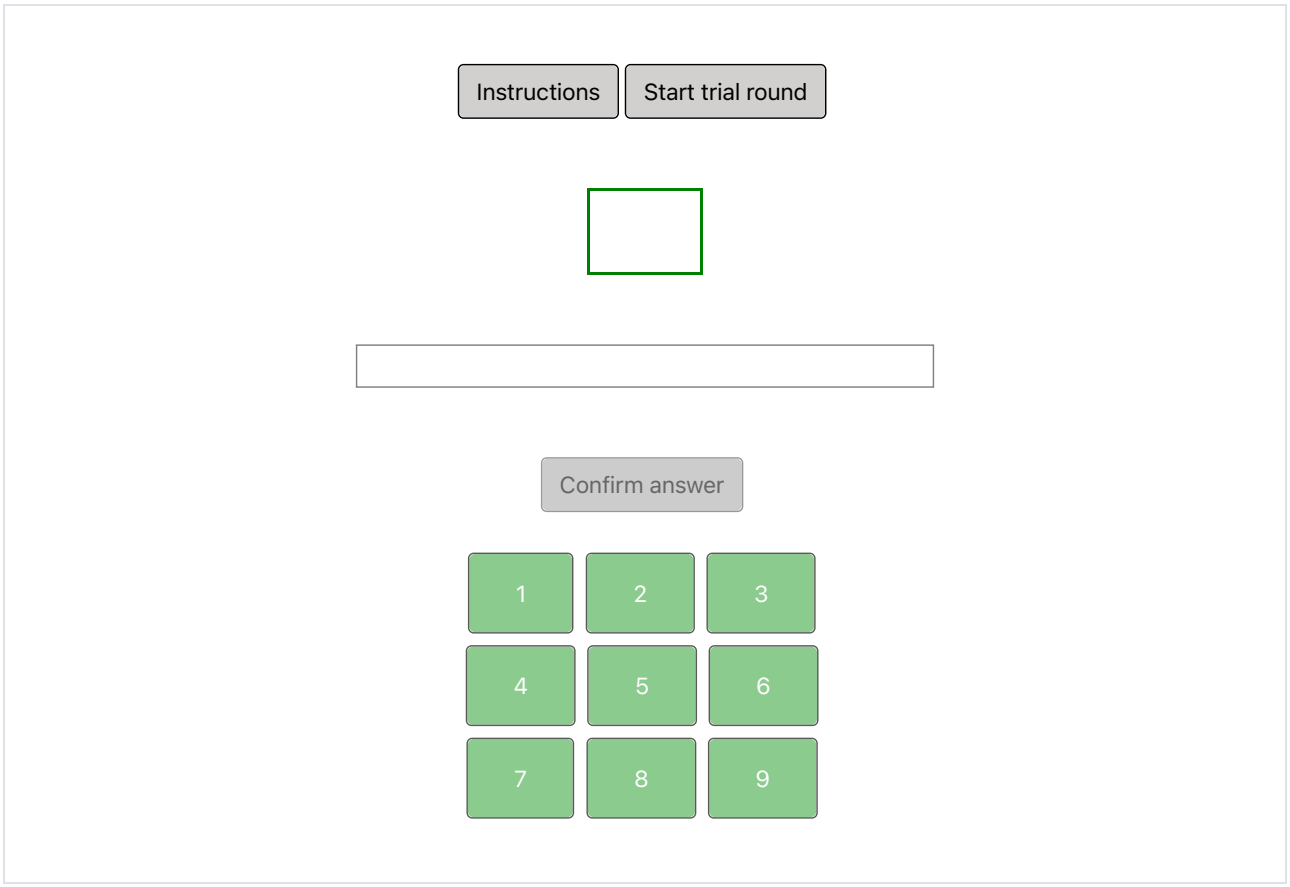
On the next page, we will ask you to complete Task 3 again (see example image). The procedure and the instructions are identical. You can view these instructions again at the beginning and between rounds by clicking on the '*Instructions*' button.

Example of the task screen:



Next

Task 3



Financial Decision

On the next three pages, we will introduce you to **three non-profit organizations** and ask you on **each of the three pages** to make an **independent financial decision** about the organization presented. **Important**: The financial decisions for one organization do not influence the decisions for the other organizations! Your three decisions are completely independent of each other.

You have **for each of these decisions** a bonus amount of **10 Euro** at your disposal. This amount is independent of the fixed basic remuneration of 5 Euro that you will receive for participating in this experiment. You can decide how much of the **10 Euro** you want to keep for yourself or donate to the respective organization. Details on the respective organization and the process will follow on the next pages.

Important: At the end of the experiment, exactly <u>one of these three organizations will be selected at random</u> and your corresponding decision will be implemented! All three organizations and thus all three of your decisions have the same probability of 1/3 of being selected.

Before you can continue with the experiment, we would like to ask you some comprehension questions:

Imagine you have made the following three donation decisions:

Organization A: You donated €10.
Organization B: You donated €8.
Organization C: You donated €3.

At the end of the experiment, **Organization C** was randomly selected. Please answer the following questions about the consequences resulting from the random selection of Organization C. Only when you have answered all the questions correctly can you make your decisions on the next pages.

1. How much in € is donated to Organization C?

2. How much in € do you receive in addition to the basic remuneration of €5?

3. How much in € is donated to Organization A?

4. How much in € is donated to Organization B?

Next

Donation to **Hilfswerk Österreich**

You have an amount of **10 Euros** at your disposal. You can decide how much of these 10 Euros you want to keep for yourself or donate to **Hilfswerk Österreich**.

Hilfswerk is a leading non-profit organization in Austria that supports people, families, and social networks in coping with life's challenges in the areas of health, family, and social matters. Hilfswerk aims to specifically support and promote the concrete quality of life of people in different life phases and various life situations.

You can donate the entire **10 Euros** to Hilfswerk Österreich, keep it all for yourself, or keep a part and donate a part. All participants will receive an official donation receipt for the total amount via email.

Please click on any area of the slider to activate the donation amount setting.

Keep Donate

Confirm Donation Amount

Donation to **Naturschutzbund Österreich**

You have an amount of **10 Euros** at your disposal. You can decide how much of these 10 Euros you want to keep for yourself or donate to the **Naturschutzbund Österreich**.

The Naturschutzbund Österreich has been working for over 110 years in the interest of the general public to ensure the lasting protection of nature as the basis of life for humans, animals, and plants. Its activities extend beyond the borders of Austria, contributing to the conservation of species and habitats and raising awareness about the value of natural and near-natural living spaces.

You can donate the entire **10 Euros** to the Naturschutzbund Österreich, keep it all for yourself, or keep a part and donate a part. All participants will receive an official donation receipt for the total amount via email.

Please click on any area of the slider to activate the donation amount setting.

Keep Donate

Confirm Donation Amount

Donation to **IG Kultur Österreich**

You have an amount of **10 Euros** at your disposal. You can decide how much of these 10 Euros you want to keep for yourself or donate to **IG Kultur Österreich**.

The central task of IG Kultur Österreich is to improve the working conditions for emancipatory cultural work. It serves as a cultural policy interest group and advisory body on behalf of cultural initiatives.

You can donate the entire **10 Euros** to IG Kultur Österreich, keep it all for yourself, or keep a part and donate a part. All participants will receive an official donation receipt for the total amount via email.

Please click on any area of the slider to activate the donation amount setting.

Keep Donate

Confirm Donation Amount

To what extent do you agree or disagree with the following statements?

The Earth is like a spaceship with very limited room and resources.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

The Earth has plenty of natural resources if we just learn how to develop them.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

Despite our special abilities, humans are still subject to the laws of nature.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

Humans are seriously abusing the environment.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

When humans interfere with nature, it often produces disastrous consequences.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

Plants and animals have as much right as humans to exist.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

The so-called ecological crisis facing humankind has been greatly exaggerated.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

Humans were meant to rule over the rest of nature.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

Humans will eventually learn enough about how nature works to be able to control it.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

If things continue as they are, we will soon experience a major environmental catastrophe.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

The balance of nature is very delicate and easily upset.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

The balance of nature is strong enough to cope with the impacts of modern industrial nations.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

We are approaching the limit of the number of people the Earth can support.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

Humans have the right to modify the natural environment to suit their needs.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

Human ingenuity will ensure that we do not make the Earth unlivable.

Strongly disagree | Disagree | Unsure | Agree | Strongly Agree

Next

Please indicate the extent to which each of the following statements describes you by using the appropriate number from the scale below.

If I could choose, I would prefer to live where I can have a view of the natural environment, such as trees or fields.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

I feel refreshed when I spend time in nature.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

I feel that I have a lot in common with wild animals.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

I feel comfortable out in nature.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

I enjoy encountering elements of nature, like trees or grass, even when I am in a city setting.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

I consider myself a steward of our natural resources.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

I think elements of the natural world are more beautiful than any work of art.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

An important part of my life would be missing if I was not able to get outside and enjoy nature from time to time.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

Learning about the natural world should be part of everyone's upbringing.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

I think of myself as a part of nature, not separate from it.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

Behaving responsibly toward nature -- living a sustainable lifestyle -- is important to who I am.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

I like to spend time outdoors in natural settings (such as woods, mountains, rivers, fields, local parks, lake or beach, or a leafy yard or garden).

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

If I had enough resources such as time or money, I would spend some of them to protect the natural environment.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

When I am upset or stressed, I can feel better by spending some time outdoors surrounded by nature.

Not at all true of me	2	3	4	Completely true of me
○	○	○	○	○

Next

Please answer the following questions about yourself

How old are you?

What is your gender?

- Male
- Female
- Non-binary

Where did you grow up?

- Big city
- Small town
- Rural area
- Mixture of city and countryside

How many years have you been living in Innsbruck or the surrounding area?

How many hours per week do you spend on average outdoors in nature?

0-4 | 5-9 | 10-14 | 15-19 | 20 or more

Next

Your Final Payout

*Your decision on the donation has been randomly selected to go to the **IG Kultur Österreich** .*

Your base payment:	€5.00
Your bonus (€10.00 minus your donation amount of €4.40):	€5.60
Your total payout, which will be transferred to you:	**€10.60**

Next

Comments

Do you have any additional comments or anything else you'd like to tell us about this study? (optional)

You can write your comments here:

Next

Thank you for participating!

You can now **quietly** leave the room. Please do not forget your mobile phone. We also kindly ask you to return your seat card to the experimenter at the front and leave your seat in an orderly manner. Thank you!

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Sarah Lynn Flecke, Rene Schwaiger, Jürgen Huber, Michael Kirchler

Nature Experiences and Pro-Environmental Behavior: Evidence from a Randomized Controlled Trial

Abstract
We conducted a randomized controlled trial in a lab and natural setting to investigate whether exposure to nature leads people to behave more pro-environmentally. We further investigated whether attention restoration mediates this effect. Participants were randomly assigned to one of four conditions, in which they spent 15 minutes either walking through a park, walking through an urban area with limited greenery, viewing a video of a nature walk, or remaining seated in the lab (taking a break). Participants were given a EUR 10 endowment to keep for themselves or donate to either a conservation, social, or cultural charity. We measured the frequency and the amount donated to the conservation charity as indicators of pro-environmental behavior. We found that real nature exposure positively affects pro-environmental behavior compared to viewing a nature video. This effect was mediated by self-reported restoration, however, the mediator was not robust to controlling for environmental concern and nature identity, implying that attention restoration as a mechanism is driven by more environmentally concerned and connected individuals.

ISSN 1993-4378 (Print)
ISSN 1993-6885 (Online)