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Influence of indoor nature exposure (INE) on health and behaviour

Submission date
06/06/2019

Recruitment status
No longer recruiting

Registration date
13/06/2019

Overall study status
Completed

Last Edited
07/04/2020

Condition category
Mental and Behavioural Disorders

[ ] Prospectively registered
[ ] Protocol
[ ] Statistical analysis plan
[X] Results
[ ] Individual participant data

Plain English summary of protocol

Background and study aims
Exposure to natural environments is good for your health. Research has shown that contact with nature can prevent exposure to harmful environmental conditions, improve attention and cognitive function, and promote healthy behaviours such as physical activity. However, data from time-use studies conducted in several industrialized countries shows that people may spend more than 90% of their time indoors. The main aim of this study is to investigate if exposure to nature in indoor environments is associated with health. Specifically, the study employs an experimental design to explore the relationship between exposure to indoor nature and stress, mood and pro-social behaviour.

Who can participate?
University students studying at Dalhousie University

What does the study involve?
Participants are randomly allocated to either a room with several natural elements (plants, pictures of nature, windows with nature views, natural scents and sounds of nature) or to a room with no windows or any of the natural features previously listed. They are then connected to a device via three electrodes that measures variations in heart rate and remains connected until completion of the session. The participant then completes a series of questionnaires to assess their feelings in response to their environment, a stress inventory, and their relatedness to nature. These questionnaires are completed in about 10 minutes. Five minutes after completion of the initial surveys the participants receive a series of “filler tasks” that include a search and memory test and digit span test that can be completed in about 15 minutes and are designed to assess performance in memory and recall. On completion of the filler tasks the participants fill out another series of surveys to assess mood, their response to the environment, and a survey to assess their potential for exercising pro-social behaviour.

What are the possible benefits and risks of participating?
There is no guarantee of benefit from the study although participation in the study may provoke a deeper more personal understanding of one’s connection to their environment. It is possible that some participants may not wish to reveal their mood, stress, health, or experiences with nature. However, participation in this study is completely voluntary, and if at any time,

individuals do not feel comfortable participating, they will have the right to withdraw. Participants will be reminded that all responses are anonymous. Additionally, some participants may have an adverse reaction to the organic scent (pine bark oil).

Where is the study run from?
The study is run from the Environmental Science program in the Faculty of Science at Dalhousie University (Canada)

When is the study starting and how long is it expected to run for?
May 2014 to May 2015

Who is funding the study?
The study received no direct funding. However, a student who used the results from the study to develop a doctoral thesis receives external funding from national, peer-reviewed granting agencies.

Who is the main contact?
Dr Daniel Rainham
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Contact information

Type(s)
Scientific

Contact name
Dr Daniel Rainham

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Additional identifiers

Clinical Trials Information System (CTIS)
Nil known

ClinicalTrials.gov (NCT)
Nil known

Protocol serial number
2014-3274

Study information

Scientific Title
Nurturing nature-understanding the impact of indoor nature on human health and behavior

Acronym
NATUREx

Study objectives
Exposure to indoor nature (INE) created from biophilic design is associated with changes in stress, mood, and behaviours of young adults.

1. Nature and stress:
1.1. To objectively measure physiological stress before, during and after exposure to an indoor nature environment (INE) or a non-INE environment
1.2. To objectively measure changes in physiological stress from before, during and after exposure to INE or a non-INE
2. Nature and mood:
2.1. To assess mood after exposure to INE or a non-INE environment
2.2. To measure change in mood from before to after exposure to INE or a non-INE environment
3. Nature and pro-social behaviours: To assess whether INE prompts higher frequency of pro-social behaviours after exposure to INE or a non-INE environment
4. Nature and restoration:
4.1. To measure the difference in self-perceived environmental restoration between an INE or a non-INE environment
4.2. To assess whether an individual's self-perceived environmental restoration influences their outcomes in themes A-C
5. Nature and individual factors: To assess whether an individual's nature connection, sex and age influences their outcomes in themes A-C

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 17/09/2014, Dalhousie University Social Sciences and Humanities Research Ethics Board (Office of Research Services, PO Box 15000, Halifax, NS, B3H 4R2, Canada; Tel: +1 (0)902 494 3423; Email: ethics@dal.ca), ref: 2014-3274

Study design
Mixed 2x2 factorial design

Primary study design
Interventional

Study type(s)
Quality of life

Health condition(s) or problem(s) studied
Nature and stress, mood, pro-social behaviours, and restoration

Interventions

The intervention context is an office environment at the university. A short screening measure was used during initial contact with participants, including screening for known cardiovascular illnesses (as this may impact physiological stress measure such as heart rate), allergy to organic products and/or scents, and consumption of caffeine (this may also impact heart rate) within the last hour. A positive response on the screen means the participant is ineligible, and unable to participate in the study.

Participants will be assigned to either an experimental or control condition using the online tool "Research Randomizer" (Urbaniak & Plous, 2008). The experimental condition will be used to create a multisensory indoor nature environment. This condition will be equipped with a small table, chair, and multiple physical stimuli which have been shown to induce restorative effects. These stimuli will include a window that provides natural lighting, and several green potted plants. All plants will be flowerless green leafy species since variations in colour may influence responses.

Additionally, natural essential pine bark oil (made from the outer bark of pine trees (Pinus sylvestris)) will be provide olfactory stimulation, and low sounds of nature will be used as auditory stimuli. Four to six drops of the oil will be mixed with 2 cups of warm water, and each plant will be sprayed twice with this mixture before the start of each experiment to ensure that the amount of scent is not overpowering or distracting. Some studies have found people who are allergic to pollen or natural plant-based oils experience a negative reaction to essential pine bark oil, but this reaction is mostly found when pine oil extract is used topically or ingested rather than smelled.

The control condition for this study will be a small testing room with a table and chair, and no nature-base stimuli. This room will be similar in aesthetic to the learning environments at the university.

Intervention Type
Other

Primary outcome(s)
There are three main outcome measures measured across five possible timepoints (T1-T5):
1. Heart Rate Variability: HRV will be recorded throughout the experiment using the EquivitalTnR, an electrocardiogram monitor, which will be attached to the participant's chest and will store the data of the R-R interval. The accompanying software will be used to analyze the data using the entropy methods. Measured from T1 through to R5 continuously.
2. Mood: The Positive and Negative Affect Schedule (PANAS) is a 20-item measure designed to evaluate both positive (PA) and negative affect (NA). The measure uses a 5-point Likert-type scale, ranging from 1 = very slightly or not at all, to 5 = extremely. Example items include "inspired" for a positive item, and "scared" as a negative item. The 20 items are divided into two subscales (PA and NA), each comprised of ten items. Measured at T2 and T4.
3. Perceived Restorativeness: The Perceived Restorativeness Scale (PRS) consists of 29 items to measure the five restorative properties of attention restoration (ART) between environments. The PRS is a reliable instrument and has been validated in a variety of populations, most often undergraduate students. A short-form of the PRS was developed by Berto (2005), and consists of five statements corresponding to the five ART components. Each statement is rated on an 11-point Likert scale (from 0 = not at all to 10 = completely). Measured at T4.
4. Prosocial Behaviour: To measure pro-social behaviour, students will be asked if they would like to donate the $5 participation compensation to a charity rather than receive the compensation. Participants will be asked at the end of their post-exposure survey. Measured at T5.

T1: Exposure to condition* and initial questionnaires (Time 0:00 to 10:00)
T2: Exposure to condition no task (Time 10:00 to 15:00)
T3: Exposure to condition with filler tasks (Time 15:00 to 25:00)
T4: Exposure to condition with memory task (Time 25:00 to 30:00)
T5: Exposure to condition and post-exposure questionnaires (Time 30:00 to 35:00)
*Note that exposure to condition duration is 35 min total; heart rate is measured for the entirety of exposure

Key secondary outcome(s))
1. Nature connectedness assessed using the Short Form Version of the Nature Relatedness Scale (NR-6). This project will investigate the potential confounding impact of nature connectedness, sex, and age, rather than the casual or mediating impact. The NR-6 is a 6-item Likert-type instrument that measures how an individual views their relationship with the natural world (Nisbet & Zelenski, 2013). The Likert scales ranges from 1 = disagree strongly to 5 = agree strongly. Sample items include “My ideal vacation spot would be a remote, wilderness area”, “My relationship to nature is an important part of who I am”. Measured at T1.
2. Participant demographic information will be recorded to describe the sample and test for potential confounding variables. This information will include: sex, age, and existing health conditions that may impact the current study. Participants will also be asked if there are any notable stressors in their life at the moment, such as increased stress from exams, interpersonal conflicts, or upcoming deadlines. Measured at T1.

Completion date
01/05/2015

Eligibility

Key inclusion criteria
Current student at the university

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Adult

Sex
All

Key exclusion criteria
Participants are ineligible to participate if:
1. They have a known cardiovascular illness (as it may conflict with heart rate measurement)
2. They have an allergic reaction to organic-based scents
3. They have consumed caffeine at least an hour prior to arrival to the study location

Date of first enrolment
01/10/2014

Date of final enrolment
01/03/2015

Locations

Countries of recruitment
Canada

Study participating centre
Environmental Science, Dalhousie University
1355 Oxford Street, LSC827
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Sponsor information

Organisation
Dalhousie University

ROR
https://ror.org/01e6qks80

Funder(s)

Funder type
Other

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated during and/or analysed during the current study are/will be available upon request from Daniel Rainham (Daniel.rainham@dal.ca). Requests may be made for deidentified, individual data including demographic, HRV averages for all time points and scores on all questionnaires.

IPD sharing plan summary

Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article	results	18/10/2019	07/04/2020	Yes	No
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes