ISRCTN48943261 https://doi.org/10.1186/ISRCTN48943261

Restorative potential of different noise-exposed natural and urban environments

Submission date
23/11/2023

Recruitment status
No longer recruiting

Registration date
24/11/2023

Overall study status
Completed

Last Edited
19/03/2026

Condition category
Mental and Behavioural Disorders

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

Plain English summary of protocol
Background and study aims
Life is very stressful for many people nowadays. One possibility to restore and to reduce stress could be spending time in natural environments. Earlier studies have compared whether people restore more when they go for a walk in an urban or a natural environment. Most of these previous studies do not consider that urban environments are not only less green than natural environments, but typically also feature increased levels of noise. So, the benefits of exposure to natural compared to urban environments reported in earlier studies might be less due to "greenness" of the natural environment than to additional stressors like traffic noise in the urban environment. The aim of this study is to examine whether people restore more when walking in natural than in urban environments, taking the road traffic noise exposure during the walks in the respective settings into account. In addition to investigating how much people restore, depending on where they go for a walk (urban or natural environment), the study also investigates the effects of how individuals go for a walk and which inner attitude they adopt while walking. Thus, the study also examines whether helping people to be more mindful while walking in natural environments may increase the potential positive effects of walking in natural environments.

Who can participate?
Healthy individuals aged 18 years or older

What does the study involve?
Participants will go for a guided group walk along a predetermined route for 30 minutes in the city of Zürich, Switzerland. Participants will walk in either an urban environment with high traffic noise, an urban environment with low traffic noise, a forest with high traffic noise, a forest with low traffic noise or a forest with low traffic noise in which participants walk with a mindfulness intervention. Participants will answer a questionnaire before and after the walk, they will do an attention test and physiological stress will be assessed via salivary cortisol levels and skin conductance.

What are the possible benefits and risks of participating?
Participants may benefit from reduced stress and restoration. The level of potential risk is judged to be minimal. A possible risk is irritation of the skin from detaching the two electrodes that were put on one of their hands to measure skin conductance during the walk.

Where is the study run from?
Swiss Federal Institute for Forest, Snow and Landscape Research WSL (Switzerland)

When is the study starting and how long is it expected to run for?
November 2020 to June 2024

Who is funding the study?
Swiss National Science Foundation (Switzerland)

Who is the main contact?
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Contact information

Type(s)
Public, Scientific, Principal investigator

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Additional identifiers

Protocol serial number
193847

Study information

Scientific Title
Psycho-physiological effects of walking in different noise-exposed natural and urban environments with or without mindfulness intervention

Acronym
JS

Study objectives
1. Walking in forest settings, compared to walking in urban settings, leads to a stronger increase in stress reduction, restoration, positive affect, attention, nature connectedness and rumination, as well as a stronger decrease in negative affect.
2. Walking in environments with low traffic noise, compared to walking in environments with high traffic noise, leads to a stronger increase in stress reduction, restoration, positive affect, attention, nature connectedness, and rumination, as well as a stronger decrease in negative affect.
3. Walking in forests with low traffic noise, compared to walking in forests with high traffic noise, leads to a stronger increase in stress reduction, restoration, positive affect, attention, nature connectedness and rumination, as well as a stronger decrease in negative affect.
4. Walking in urban environments with low traffic noise, compared with walking in urban environments with high traffic noise, leads to a stronger increase in stress reduction, restoration, positive affect, attention, nature connectedness and rumination, as well as a stronger decrease in negative affect.
5. Walking in forest settings with a mindfulness intervention, compared to walking in forest settings without a mindfulness intervention, leads to a stronger increase in stress reduction, restoration, positive affect, attention, nature connectedness, and rumination, as well as a stronger decrease in negative affect.

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 27/01/2022, Ethics Committee of the Swiss Federal Institute of Technology Zurich (Rämistrasse 101, Zürich, 8092, Switzerland; +41 (0)44 632 85 72; ethics@sl.ethz.ch), ref: EK 2021-N-211

Primary study design
Interventional

Study design
Randomized controlled intervention study

Study type(s)
Prevention

Health condition(s) or problem(s) studied
Stress reduction, restoration and fostering of wellbeing in healthy individuals

Interventions
Intervention study, employing a pretest-posttest design, to compare the effects of 30-minute walks in natural or urban environments with different road traffic noise levels and with or without a mindfulness intervention. Individuals will be asked to go for a guided group walk with a maximum of six participants. Participants will be randomly assigned to one of the following conditions: urban environment with high traffic noise, urban environment with low traffic noise, forest with high traffic noise, forest with low traffic noise. A fifth condition will consist of a walk in a forest with low traffic noise, in which participants walk with a mindfulness intervention. Data will be assessed before (t1) and directly after (t2) the walk. After this, participants will be

instructed to walk individually for three times during the next ten days. Ten days after participating in the field experiment, participants will receive an invitation to respond to a third questionnaire (t3).

The study employs a between-subject design and participants will be randomly allocated to one of the study conditions by the random generator of the online survey tool SoSci Survey.

Intervention Type
Behavioural

Primary outcome(s)
1. Perceived restoration following the walk, measured by a slightly modified version of the restoration outcome scale (ROS) after the walk on site and 10 days afterwards
2. Physiological stress, measured by assessing participants' salivary cortisol as a physiological stress marker at three points: directly after participants arrive at the test site, right before the walk starts, and directly after the walk on site.

Key secondary outcome(s)
1. Positive and negative affect is assessed using the Positive and Negative Affect Schedule (PANAS) questionnaire before and after the walk on site.
2. The perceived restorative quality of the environments examined in this study is assessed by the Perceived Restorativeness Scale-11 after the walk on site and 10 days afterwards
3. Rumination is assessed with the German version of the Perseverative Thinking Questionnaire (PTQ) before and after the walk on site and 10 days afterwards
4. Nature connectedness is measured with the short-form Nature Relatedness Scale (NR-6) and the Love and Care for Nature Scale (LCS) before the walk on site, after the walk on site and 10 days afterwards
5. Noise annoyance is assessed with the 11-point ICBEN (International Commission on Biological Effects of Noise) scale after the walk on site.
6. Participants' individual experience of soundscape during the walk is assessed in accordance with the ISO/TS 12913-2 (International Organization for Standardization, 2018) after the walk on site
7. Life satisfaction is measured with the German General Life Satisfaction Short Scale (L-1) before and after the walk on site, and 10 days afterwards
8. Noise sensitivity is assessed with one item, asking participants how strongly they agree with the statement "I am noise sensitive". The item is rated on a 5-point rating scale ranging from 1 (do not agree at all) to 5 (agree very much). Noise sensitivity is assessed after the walk on site.
9. State mindfulness is assessed with the State Mindfulness Scale before and after the walk on site
10. Trait mindfulness is assessed with the short form of the Kentucky Inventory of Mindfulness Skills before the walk on site and 10 days afterwards
11. Skin conductance level is measured continuously throughout the walk on site via electrodermal activity sensors (Shimmer3 GSR+ sensor, Simmer sensing, Dublin, Ireland), reflecting physiological arousal.
12. Attention is assessed with the Necker Cube Pattern Control Test before and after the walk on site with a cognitive test
13. Noise is assessed with continuous audio recordings using a free-field measurement microphone during the walks

Completion date
07/06/2024

Eligibility

Key inclusion criteria
1. Aged 18 years and older
2. Physically able to walk for half an hour at a moderate pace
3. Have no diagnosed hearing problems
4. Do not take cortisone for medical reasons
5. BMI <35 kg/m²

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Mixed

Lower age limit
18 Years

Upper age limit
120 Years

Sex
All

Total final enrolment
526

Key exclusion criteria
1. Younger than 18 years
2. Diagnosed hearing problems
3. Take cortisone for medical reasons
4. BMI >35 kg/m²

Date of first enrolment
16/05/2022

Date of final enrolment
06/06/2024

Locations

Countries of recruitment
Switzerland

Study participating centre

Swiss Federal Institute for Forest Snow and Landscape Research WSL
Zürcherstr. 111
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Sponsor information

Organisation
Swiss Federal Institute for Forest, Snow and Landscape Research

ROR
https://ror.org/04bs5yc70

Funder(s)

Funder type
Research organisation

Funder Name
Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung

Alternative Name(s)
Schweizerischer Nationalfonds, Swiss National Science Foundation, Fonds National Suisse de la Recherche Scientifique, Fondo Nazionale Svizzero per la Ricerca Scientifica, Fonds National Suisse, Fondo Nazionale Svizzero, Schweizerische Nationalfonds, The Swiss National Science Foundation (SNSF), SNF, SNSF, FNS

Funding Body Type
Private sector organisation

Funding Body Subtype
Trusts, charities, foundations (both public and private)

Location
Switzerland

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary

Data sharing statement to be made available at a later date

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		18/03/2026	19/03/2026	Yes	No
Protocol article		06/05/2024	08/05/2024	Yes	No