

## Sounds\_Online (#67702)

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### 1) Have any data been collected for this study already?

No, no data have been collected for this study yet.

### 2) What's the main question being asked or hypothesis being tested in this study?

Listening to a short sound intervention providing either a natural or an urban soundscape will differently affect cognitive behavior and self-reported clinical and non-clinical measures. Natural soundscapes will further be divided into a recording of highly diverse bird calls and a recording representing a low diversity of bird calls. Similarly, the urban soundscapes will further be divided into a recording of highly diverse vehicle and city sounds and a recording of vehicle and city sound with a low level of diversity. Natural soundscapes have been reported to have a positive effect on cognition compared to urban soundscapes (1). Species diversity has been shown to be related to human well-being (2). But to our knowledge no studies exist testing its effect on cognitive performance. The main question being asked will be: Does the difference in biodiversity within the natural soundscapes also differ in terms of their positive effect on cognition? Does this difference also arise within the diverse and non-diverse urban soundscapes? We hypothesize based on the current literature that natural soundscapes will have a positive effect on cognition and that a high species diversity might enhance this effect via an increase in well-being (3–5).

### 3) Describe the key dependent variable(s) specifying how they will be measured.

Before and after exposure to (high/ low) biodiverse bird audios vs. (high/ low) diverse city sounds (i.e. including traffic and other city noise) we will assess:

- cognition with an n-back task (programmed with the software millisecond; Dual Task N-Back by Jaeggi et al., 2010; <https://www.millisecond.com/download/library/nback/>), whereby the performance score is the main outcome (i.e. number of correct trials)
- mood/ emotions with the State Trait Anxiety Inventory [STADI] (6)
- paranoia with a brief, state adapted version of the paranoia checklist (7)

### 4) How many and which conditions will participants be assigned to?

The experiment will be carried out in a between-subject design with four conditions (2x2).  
The two factors applied will be environment (natural or urban) and diversity (high or low)

- Nature High
- Nature Low
- Urban High
- Urban Low

### 5) Specify exactly which analyses you will conduct to examine the main question/hypothesis.

Repeated Measures Analysis of Variance (rmANOVA) will be the main instrument of analysis. The interaction between group and time will be examined.

### 6) Describe exactly how outliers will be defined and handled, and your precise rule(s) for excluding observations.

- We will compute the overall mean and standard deviation across all conditions and exclude at 2.5 SD below/above the mean
- We will exclude participants who will incorrectly answer our attention check question.

### 7) How many observations will be collected or what will determine sample size? No need to justify decision, but be precise about exactly how the number will be determined.

We will offer the participation on the crowdsourcing platform prolific for healthy participants. G\*Power 3.1.9.7 analysis ( $f = 0.10$ ;  $\alpha = 0.05$ ,  $\text{power} = .90$ , 4 groups, correlation between rep. measures  $r = 0.60$ ) indicates a minimum  $N = 288$  for the rm ANOVA

### 8) Anything else you would like to pre-register? (e.g., secondary analyses, variables collected for exploratory purposes, unusual analyses planned?)

An additional research question is whether biodiverse sounds vs. urban sounds affect paranoid states, as psychosis has higher ORs to occur in dense urban vs. rural areas, whereby the mechanisms and influencing factors (e.g., exposure to green, exposure to biological stressors such as air pollution, exposure to social stressors such as migration, social exclusion/ ostracism, poverty, etc.) remain largely unclear (see 6 for a comprehensive review). One potential influencing factor is exposition to noise as a stressor. In a study in a subclinical sample with individuals with heightened vulnerability for psychosis, and a successor study in a sample with individuals diagnosed with psychosis (acute or remitted), it has been found that experimental exposure to building site noise significantly increase paranoia (9,10). In addition, we will analyze 4 selected items of the modified Differential Emotions Scale by Fredrickson (validated German version: (11), which reflect positive affect not commonly addressed in mood/ emotion scales: awe, inspiration, curiosity, and

peacefulness, adapted to a 0-100% format.