

# Reproducibility review of: Urban sound mapping for wayfinding - A theoretical approach and an empirical study

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## Reviewed paper

Nuhn, E., Hamburger, K., and Timpf, S.: Urban Sound Mapping for Wayfinding – A theoretical Approach and an empirical Study, AGILE GIScience Ser., 4, 9, <https://doi.org/10.5194/agile-giss-4-9-2023>, 2023

## Summary

The data of the paper under reproduction is published on figshare under a CC-BY-4.0 license. In total, three tables, three figures, and two data points embedded into the text are eligible for reproduction. All have been successfully reproduced. The authors showed concern and dedication to support reproducibility of their work.

Reproduction was *successful*.

# Reproducibility reviewer notes

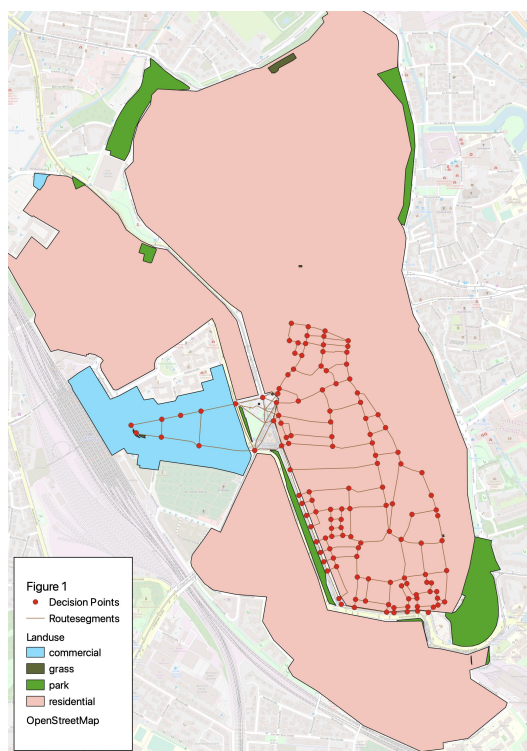
The submission contains a Data and Software Availability Section which links to a figshare repository containing both a README and the related data files for the displayed figures. The repository is located at <https://doi.org/10.6084/m9.figshare.22109987>.

In addition, the repository contains the questionnaires used for the conducted studies and the raw sound files for the introduced sound mapping. The README provides a basic introduction into the folder structure and provides translations for the sound categories from German to English. The repository is published under a CC-BY-4.0 license.

In total, eight distinct parts are eligible for reproduction: Tables 1, 2, and 6, Figures 1, 2, and 3, as well as statistical overviews for the two conducted studies in Section 3.1. The following sections will summarise reproduction of the individual parts in the order as they appear in the paper.

## Figure 1

All relevant shapefiles for Figure 1 are given in folder **Figures/Figure 1**. The reproduced figure based on QGIS is displayed below. The QGIS source file for this and subsequent reproduced Figures based on QGIS is given in file **paper-279.qgz** in the OSF repository associated with this report.



**Figure 1:** Reproduction of Figure 1 in reproduced paper

## Table 1

The total number of sound categories is given in file **Online Studies/Study\_1/Study\_1\_Analysis.xlsx** in range J22-K30. Note that all presented files are in German. The individual category names can be translated by non-German speakers using the provided README. Note also that this and subsequent files include not just information on acoustic landmarks, but also on visual and olfactory landmarks. The authors mention this fact in their README and state that only the acoustic data is relevant for the reproduced paper.

## Section 3.1, statistical overview of studies 1 and 2

Raw data for the statistical overview of studies 1 and 2 in Section 3.1.1 and 3.1.2 are given in files **Online Studies/Study\_{1,2}/Study\_{1,2}\_Result\_Social Science Survey.xlsx** respectively. Both statistical overviews provide data on the count (N) of participants, the mean (M) and standard deviation (SD)

of their age, as well as a gender count breakdown. For the purpose of this reproduction, an R file has been written to extract and aggregate the necessary data points, which is given in file `analysis_3_1.R`. Refer to the README file in the OSF repository for guidance on execution. Raw data is given in columns BE and BF for Study 1 and CB and CC for Study 2.

Based on this script, all data points presented in the paper are reproducible. The reproduced values are listed below.

**Table 1:** Statistical overview of Studies 1 and 2. Correspond to data in Section 3.1.1 and 3.1.2 in reproduced paper.

Study	N	M	SD	N_female	N_male	N_diverse
1	26	28.500	10.992	23	3	0
2	39	25.667	11.029	30	8	1

Note that the authors reported a correction of the data shown in the original submission. The corrected data points match the above listed data. The final submission also contains the corrected data.

**Table 2**

Raw data for Table 2 is given in file `Online Studies/Study_2/Study_2_Analysis.xlsx`, which gives an overview of the mean responses to a total of ten sound categories. Responses are split into “Frequency of use” and “Judged usefulness”. The provided data file contains the raw questionnaire response from each of the 39 participants. For the purpose of this reproduction, an R file has been written to extract and aggregate the necessary data points, which is given in file `analysis_table_2.R`. Note that the values in Table 2 of the reproduced paper are rounded to whole integers.

Based on this script, all data points presented in the paper are reproducible. The reproduced values are listed below. In keeping with the paper under reproduction, the presented values are additionally displayed as rounded to whole integers.

**Table 2:** Reproduction of Table 2 in reproduced paper. Rounded values correspond to values in reproduced paper.

	Frequency of use	Frequency of use (rounded)	Judged usefulness	Judged usefulness (rounded)
Traffic noise	5.000	5	5.308	5
Trains	3.795	4	4.923	5
Conversations and voices	4.385	4	4.923	5
(running) water	3.923	4	4.436	4
Wind (e.g., in trees)	3.000	3	3.590	4
Chirping birds	2.795	3	3.359	3
Other animal noises	2.667	3	3.436	3
Music	4.128	4	4.692	5
Dishes (rattle)	2.923	3	3.744	4
Warning signals	3.128	3	4.513	5

**Table 6**

Raw data for Table 6 is given in the GeoDataBase file `Sound.gdb`, which provides metadata on the mapped acoustic landmarks, including location and loudness measured in decibel.

For the purpose of this reproduction, an R file has been written to extract and aggregate the necessary data points, which is given in file `analysis_table_6.R`. Note that this script depends on the library “Simple Features for R” `sf` (1), which required a modified install command. Refer to the README in the report OSF repository for more information.

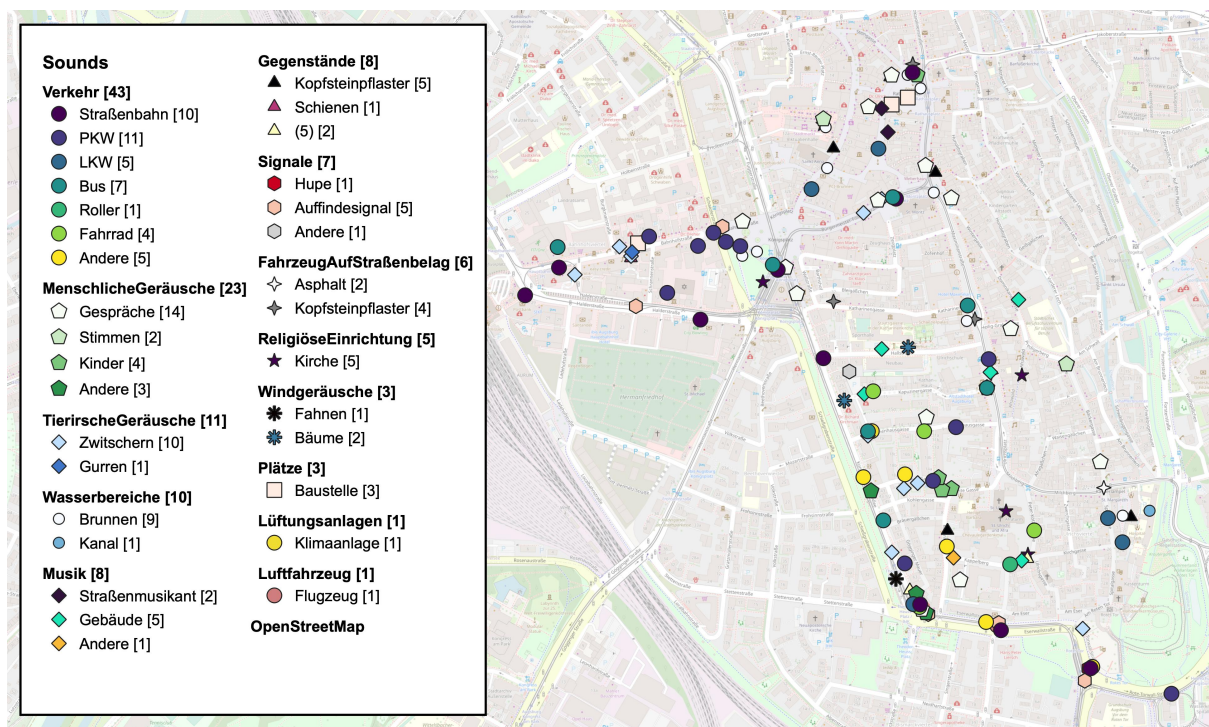
Based on this script, all data points presented in the paper are reproducible. The reproduced values are listed below.

**Table 3:** Reproduction of Table 6 in reproduced paper.

Type	N	min	max	mean	sd
Aircraft	1	34	34	34.00	
Animal noise	11	35	55	41.91	6.58
Human noise	23	32	70	43.13	8.44
Music	8	33	63	44.62	8.60
Object	8	35	49	41.75	4.80
Place	3	46	120	75.67	39.12
Religious facility	5	30	67	43.00	14.54
Signal	7	46	62	52.17	5.85
Siren	1	48	48	48.00	
Traffic	43	24	85	52.02	14.28
Vehicle on road surface	6	44	82	53.83	14.29
Ventilation system	1	38	38	38.00	
Water area	10	43	61	49.70	5.52
Wind noises	3	38	62	50.67	12.06

**Figure 2**

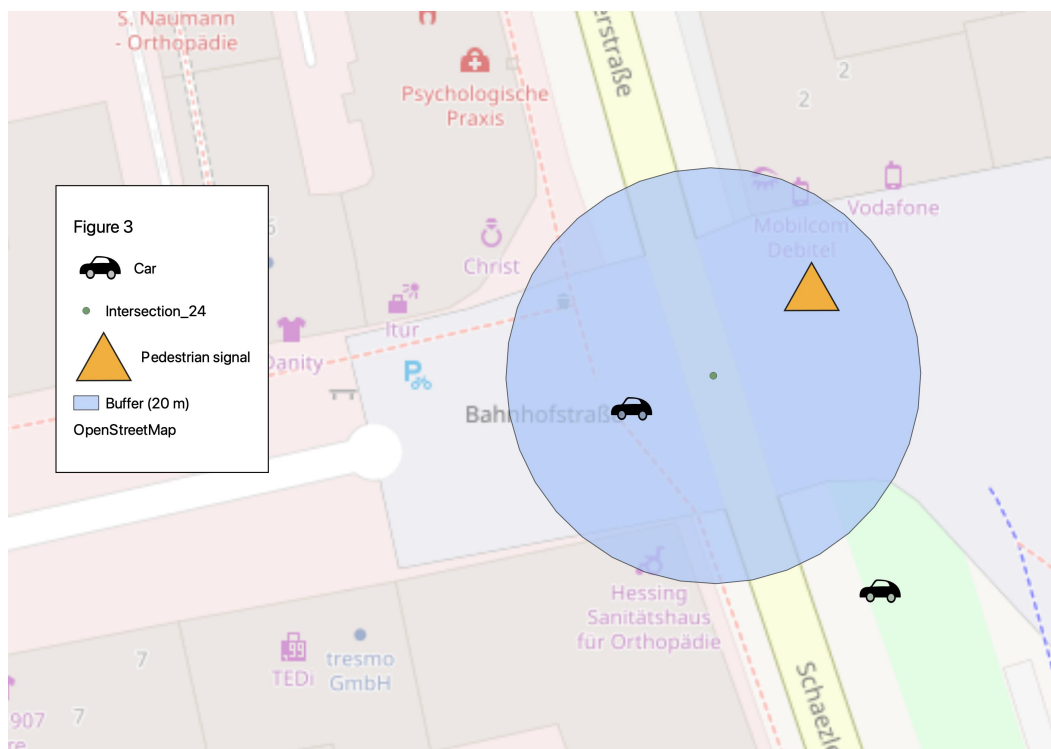
Figure 2 visualises the mapped acoustic landmarks on a map. The raw data is again present in the GeoDataBase file `Sound.gdb`. For the purpose of this reproduction, QGIS 3.28 was used for visualisation. The figure below displays the resulting visualisation. Sound categories and sub-categories are displayed as found in the data file and have not been translated from German to English. Background tiles are provided by OpenStreetMap.



**Figure 2:** Reproduction of Figure 2 in reproduced paper

**Figure 3**

All relevant shapefiles for Figure 3 are given in folder `Figures/Figure 3`. The reproduced figure based on QGIS is displayed below.



**Figure 3:** Reproduction of Figure 3 in reproduced paper

## Comments to the authors

Reproduction was relatively straight-forward and quick. Especially the reproduction of all three Figures was trivial as the authors provided all necessary data in an easy-to-use format.

Reproducing the tables and data in Section 3.1 however involved a bit more work. While the documentation explains the location and purpose of all provided files, it does not describe which parts of which files were involved for which Tables. For future submissions *I recommend adding a mapping of data to figures or tables for all data files.*

In addition, reproduction of Table 6 and the data in Section 3.1 involved simple aggregation steps, which would either have to be done by hand, using a spreadsheet tool or ideally be done automatically using a script similar to what has been written for the scope of this reproduction. For future submissions *I recommend to automate the data aggregation steps* for example using a script file.

## Data and Software Availability

All data and software developed for this reproduction is published under a CC-BY-4.0 license in the OSF repository accompanying this report.

## References

[1] Edzer Pebesma, 2018. Simple Features for R: Standardized Support for Spatial Vector Data. The R Journal 10:1, 439-446. <https://journal.r-project.org/archive/2018/RJ-2018-009/index.html>