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# THE SCIENCE OF SOUNDSCAPE – SUMMARY OF THE EVIDENCE BASE FROM THE UK ACOUSTICS COMMUNITY

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## 1 INTRODUCTION

This paper sets out a summary of the evidence within the emerging field of soundscape, which was assembled following a request for information by the House of Lords (HOL) Scientific and Technology committee in their recent inquiry into the evidence base for the effects of noise on human health. There are also positive aspects of sound on human health, and alternative approaches to considering sound/noise (e.g. soundscape) but the evidence base is predominantly from academia, and lacks practical implementation examples across the industry due to a current lack of a clear framework and legislation that requires it. This paper aims to provide insight to the physiological and mental health and wellbeing benefits of a soundscape approach, which was provided in evidence to the inquiry. This paper also aims to provide a comprehensive summary of the corpus of evidence on which the science of soundscape can be based, with some key case studies included. It identifies the drivers for including a scientific application of a soundscape approach by acousticians and other professionals and recommends areas for further work. This paper also brings together and represents the opinions of the authors, representing a very broad scientific review of this field. The HOL report outlines the state of the art and research gaps on noise and the negative impacts of sound. This work is hoped to complement the HOL report setting out the merits of including positive aspects of sound within a strategy for future, within a strategy for future regenerative design of environments for species health and wellbeing benefits that forms part of delivering sustainability.

## 2 BACKGROUND

### 2.1 Soundscape

Within the scope of the House of Lords Scientific and Technology committee recent investigation, we rely on the definition set out in ISO 12913-1:2014<sup>8</sup>, being the sound environment as perceived in context<sup>1</sup>. This introduces the challenge that the formal assessment of sound requires not only objective measurements but also the use of subjective methods, for example questionnaire social survey techniques. This presents a barrier to many in traditional acoustic consultancy but is an area that is evolving quickly.

## 2.2 House of Lords committee question

As part of the questions within oral evidence Lord Wei asked Peter Rogers, representing the Institute of Acoustics, in oral evidence to the inquiry<sup>2</sup> : *“You mentioned that you have done a lot of work on soundscape principles to enhance well-being. How would the idea of improving the soundscape get embedded in a regulatory policy framework?”*

In his response Mr Rogers said: *We have the advantage of Wales leading the way at the moment and putting some guidance and policy together on that. I would urge the Government to consider taking a similar line, because the reality is that there is general evidence supporting the idea that where we are able to connect with natural sound we feel better and well-being improves”. He went on “that evidence base is new and is strengthening quickly, but we could do with some assistance to accelerate that change”. Lord Wei then asked “Could you let us know where that evidence base comes from, because, as you say, it is new and it has been hard to find that?”*

Mr Rogers replied *“There is a strong body of evidence there. You have heard it in some of the other evidence. I am happy to provide a list of sources for that covering this whole area, but there is a lot more work to be done in this area if it can be given the ministerial attention”.*

The premise for the point being discussed was that designing for healthy urban soundscapes, as recommended by the United Nations, Frontier Report 2022<sup>29</sup>, should be considered. This is the other side of the coin to controlling noise pollution (about which there is already a relatively mature approach).

## 2.3 UN Frontier report recommendations

The report considered the emerging environmental issues to have profound effects on our societies, economy and ecosystems, although it is largely focused on noise pollution as the threat. It does however expand the consideration and propose that a shift to consider positive/ healthy soundscape identified as an antidote.

The report highlighted two major shortcomings in addressing noise pollution as an environmental and public health issue, which can often be observed in policies in different countries around the world. The first issue is the reactive approach taken by policymakers, where the focus is primarily on retroactively reducing noise levels after the problem has arisen. This approach may be effective in managing noise sources, but it doesn't necessarily improve the overall soundscape quality. The second shortcoming is the limited perspective on sound, where policymakers tend to think of noise only in terms of discomfort, such as transport and industrial noise, without considering how to promote sounds that provide comfort and contribute to positive soundscapes. To overcome these shortcomings and achieve livable cities that are pleasant places to be, the report suggested some key strategies:

- Early consideration of environmental sounds in urban development: Policymakers should consider environmental sounds at the earliest stages of planning and design to prevent them from being an afterthought. By incorporating environmental acoustics and urban soundscapes into the development process, experts can help ensure that soundscapes are conducive to a healthy living environment.
- Integrated policies for environmental challenges: Noise pollution should be addressed alongside other environmental challenges, such as air pollution. Integrated policies can lead to co-benefits, such as traffic calming measures, green vehicle fleets, energy-efficient

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<sup>2</sup> Q60, captured within the transcript : [committees.parliament.uk/oralevidence/12979/html/](https://committees.parliament.uk/oralevidence/12979/html/)

buildings, green corridors, and engineered noise control solutions using downcycled materials.

- Shift in policymaking perspective: Policymakers need to extend the scope of their approach and view environmental sounds as opportunities to promote healthy living environments for all age, gender, and social groups. Positive soundscapes, which prioritize natural sounds like flowing water, birdsong, and wind in the trees over background traffic noise, should be preserved and cultivated.

People's perception and aural diversity: New approaches should account for people's perception of soundscapes rather than just their exposure to noise. This requires moving beyond simply measuring sound levels in decibels (dB) and considering the overall quality and diversity of sounds in urban spaces. While silence or quiet may be desirable in some contexts, creating aurally diverse and inclusive cities that support mixed uses is essential for positive soundscapes.

The report concludes *“Ultimately, city planners need to consider the public and personal health benefits of positive soundscapes when designing cities. Green spaces offer a nature-based solution for peaceful soundscapes.”* A number of areas to focus efforts were identified which strayed beyond simply noise control, including:

- Vegetated roofs attenuate sound by absorbing propagation over rooftops from street to quiet sides.
- Tree belts, shrubs, green walls and green roofs also help amplify natural sounds by attracting wildlife, and they improve the visual streetscape as well.
- Vegetation [in urban environments] increases the absorption and reduces the propagation of sound. Customized placement of tree rows behind traditional highway noise barriers or layers of vegetation on rigid noise walls can reduce noise levels by up to 12 dB.
- Green spaces, courtyards and quiet urban parks offer relief from noisy places and benefit our mental well-being.
- Indirect measures such as reducing available driving space by increasing the number of cycle lanes can reduce masking road traffic noise and reveal hidden underlying soundscapes. Also, low-emission zones encourage electric mobility, which reduces noise and improves air quality, showing benefits beyond simply noise control.
- Visual surroundings affect our perception of soundscapes and vice versa. Urban greens offer a pleasant visual effect that contributes to the development of positive soundscapes.
- Ecosystem services.
- Placemaking.

Case studies 3, 5, 7 and 8 described in section 4 of the paper incorporate green areas. The acoustical benefits of such areas have been the subject of wide-ranging research<sup>30, 31, 34</sup>. However, it is important to note that the prediction schemes used by consultants, engineers and planners at present are not sufficiently accurate to assess these benefits presently.

The above list provides a palette of opportunities for acoustic interventions in cities, since this was the scope requested by the United Nations Environment Programme (UNEP) leadership (hence, the title “Listening to Cities”)<sup>29</sup>. Therefore, it did not consider the benefit this can have in rural environments too, which provide homes to many, and places that provide a restorative refuge from manmade noise, such as national parks which may need protection as high-quality soundscapes. The application of a soundscape approach can be seen as a much broader and fundamental

opportunity that affects the health and wellness of humans in all environments encountered, whether outside or inside. It also extends to the health and success of other species<sup>1 - 40</sup>.

The remainder of this paper sets out a summary of the evidence base, which provides a wider palette and is followed by nine case studies.

### **3 EVOLUTION OF SOUNDSCAPE FROM AN ART TO EVIDENCE-BASED DESIGN OPPORTUNITY**

To summarise, the idea of soundscape is not new, originating from the composer and environmentalist Murray Schafer in the 1970's<sup>10</sup>, but the field has been emerging since then with its application through a scientific understanding in the field of acoustics. Although soundscape has its roots in music, with an artistic or compositional history, it has since also been adopted in the field of Ecology<sup>11</sup>, when considering species monitoring and by the description of the landscape using sound. It is from this work that the framework for soundscape ecology and bioacoustics<sup>1-6, 12-15</sup> has emerged. This includes the three types of sound description, namely:

- biological (biophony);
- geophysical (geophony) and
- human produced (anthrophony)

A soundscape approach, from an acoustics perspective requires a different approach which considers the “sound as perceived in context”<sup>2</sup> and may include an intervention through aural design to improve the soundscape as it is perceived. Another way of putting it is having the right sound in the right place at the right time.

This is in rather stark comparison with the area of noise pollution and health effects, which has remained largely objective. This work is linked to epidemiological dose-response relationships, which in turn have been proven to have links to health effects at a population level and cost and negative benefit analysis.

It is proposed that a soundscapes approach offers an additional important way to providing a more complete/ holistic way to tackle not only noise pollution (or places where the soundscape quality is poor), but also how soundscape quality can be optimised not only to improve human health and wellbeing, but also to contribute to biological health.

The ways in which a soundscape approach promotes healthier environments may be summarized into four distinct elements:

1. Positive sounds and how they can benefit health and wellbeing;
2. Quiet (or absence of sound) is not necessarily better than an environment that has a positive soundscape, despite the latter having a higher decibel level;
3. Natural sounds, in particular, have health and wellbeing benefits and can provide ‘psychological noise masking’ of man-made noise;
4. Inclusion for subjective, end-user surveys on the perception and desired qualities of a design or planning intervention can enhance the resulting sound environment, delivering improved health, wellbeing and quality outcomes.

In terms of UK government policy this is a way to deliver the 3rd aim of the Noise Policy Statement for England 2010, which is in the context of government policy on sustainable development and states “*where possible, contribute to the improvement of health and quality of life*”. The Welsh Government is also considering how Soundscape can be incorporated into a revision of the Air Quality Act,

currently under consideration in The Environment (Air Quality and Soundscapes) (Wales) Bill<sup>3</sup>. The Northern Ireland policy is a similar position to England and Scotland relies on planning advice note guidance.

The reference list sets out a summary of key papers which contribute to the current body of evidence<sup>7-40</sup>, with additional papers showing the historic transition of research from the early days of soundscape<sup>1-6</sup>, through ecology to the modern strong body of evidence on soundscape research. This body of evidence has reached a critical mass in the opinions of the named authors and provides a basis for applying practical design approaches that could be applied to benefit health and wellbeing of species. Where sound can be used to result in positive benefits environments can be then designed for health, and to only focus on noise pollution is considering only half of the opportunity.

## 4 CASE STUDIES

The following collection of case studies is based on a range of projects which has been delivered over the years as examples of soundscape design in practice. Nine specific examples of approaches that have adopted soundscape principles practically. These are generally external environments, but may also include the transition to inside places, and the zones between.

To demonstrate how a soundscape approach promotes a more holistic view may form part of a policy framework.

### 4.1 Case Study 1

*Sheaf Square, Sheffield*

Located as you walk into or out of the train station in Sheffield

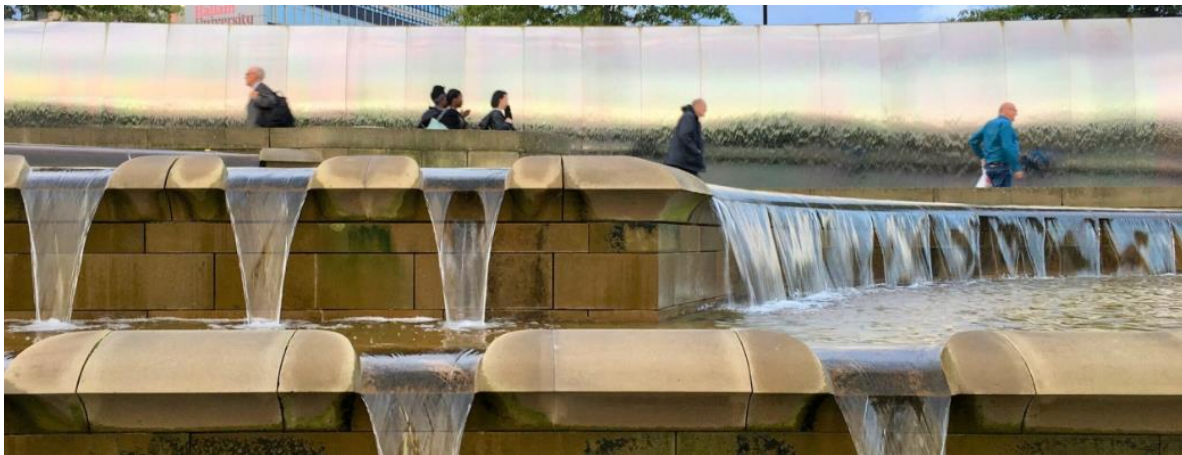


Figure 1: Case Study 1 – Sheaf Square, Sheffield

Prof. J Kang was involved in this, along with the CSI Project Team (2023, June 06).

#### Further reading

[Catalogue of Soundscape Intervention \(soundscape-intervention.org\)](https://soundscape-intervention.org)

#### Case Study 2

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<sup>3</sup> The Environment (Air Quality and Soundscapes) (Wales) Bill , also reference 37.  
<https://business.senedd.wales/mglssueHistoryHome.aspx?IId=40984>

*A soundscape project for Gatwick Airport*

Was developed by the University of Salford with St George's University of London and the Noise Abatement Society<sup>4</sup>. The project delivered a soundscape conceptual framework to define and assess options for the "Fair and Equitable Distribution" (FED) of aircraft for the first time. The transdisciplinary framework incorporates acoustics, psychoacoustics, air traffic management technology options, health, psychology and other contextually specific community and stakeholder engagement disciplines. It is proposed that the FED framework can be applied to other airports when adapted for locally significant contextual factors. The learnings from the transdisciplinary soundscape approach also have implications for and are generally applicable to noise management across all transportation modes.



Figure 2: Case Study 2 : Gatwick Airport (Fair and Equitable Distribution) of noise

Dr A J Torija Martinez, Prof. C Clark, and Lisa Lavia were involved in this.

**Case Study 3**

*Brighton & Hove City Council Environment Improvement using soundscape*

The approach of urban sound planning aims to balance the needs of the tourist and nighttime economy against the demands of residents for the peaceful and quiet enjoyment of residential areas and improved soundscape. The project was promoted by Brighton & Hove City Council Environment Improvement Team and Noise Abatement Society (NAS) with , Dr. Harry Witchel, and subsequently in the SONORUS Group, led by Chalmers University.

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<sup>4</sup> Study on fair and equitable distribution of aircraft at Gatwick; Torija et al (2022). <https://salford-repository.worktribe.com/output/1563435/study-on-fair-and-equitable-distribution-of-aircraft-at-gatwick>





Figure 3 : Case Study – Brighton & Hove Environment Improvement scheme

Prof J Kang, Dr F Aletta, and Lisa Lavia were involved in this.

#### Further reading

Alves, S., Estévez-Mauriz, L., Aletta, F., Echevarria-Sanchez, G. M. & Romero, V. P. 2015. Towards the integration of urban sound planning in urban development processes: The study of four test sites within the SONORUS project. *Noise mapping*, 2.

Aletta, F. & Kang, J. 2015. Soundscape approach integrating noise mapping techniques: a case study in Brighton, UK. *Noise Mapping*, 2.

Aletta, F., Kang, J., Astolfi, A. & Fuda, S. 2016. Differences in soundscape appreciation of walking sounds from different footpath materials in urban parks. *Sustainable Cities and Society*, 27, 367-376.

Xiao, J., Lavia, L. and Kang, J. (2017) Towards a participatory urban soundscape planning framework. *Journal of Environmental Planning and Management*, 61, 677-698.

#### Case Study 4

*Traffic management scheme for Trafalgar Square (2002).*

An early example of soundscaping in environmental management was the traffic management scheme for Trafalgar Square, which was part of the London's World Squares for All project. This involved pedestrianising the north side of the square, reducing vehicle throughput by 40%. The aim was to improve pedestrian facilities at the traffic lights, and as a consequence reduce noise levels in the square. One of the soundscape outcomes was that the fountains can now be heard on the steps of the National Gallery (whereas before they couldn't be heard).



Figure 4: Case Study 4 - Trafalgar Square, London – soundscape improvement

Partnership with the bus operators, the police and London Boroughs, Transport for London Street Management (TfLSM)

#### Further reading

<https://trid.trb.org/view/754603>

#### Case Study 5



*Project DeStress*

Learning how to Design and Engineer Soundscapes To enable Restorative Environments for Sustainable Societies is the intention of Project DeStress. This is achieved through the development of a virtual simulator as part of the research and public engagement project which explores the connections between the sounds we hear in places (soundscapes), our ability to relax and recover (cognitive restoration) and the design of the built environment. The project combines knowledge on the health and wellbeing outcomes from experiencing sound in quiet and calm places and how this varies depending on the design of the surrounding buildings and infrastructure.



Figure 5: Case Study 5 – Project DeStress example render of restorative intervention

Users of the environment simulator can design an urban park and square by manipulating features such as the material for building façades and ground surfaces, amount of vegetation, water, people, and traffic. Users experience the designed soundscape (and landscape) and can evaluate their perceived health outcomes including psychological restoration, thus extending the evidence base in this area. The aim is also for users (public or professional) to learn about current research evidence for the built environment designs' impact on soundscape and quality of life, thus raising awareness for inclusion of soundscape design in sustainable planning decisions. Physical and social features within public identified quiet urban areas were also identified through a public participatory geographic information system mapping tool.

The collaboration was between Dr Sarah Payne, Dr Neil Bruce and research team, with project partner support from Lisa Lavia, Noise Abatement Society; Prof. Marketta Kyttä, Aalto University, Finland; Jack Harvie-Clarke, Apex Acoustics and Mr Clive Bentley now of Sharps Acoustics Ltd.

**Funding**

Project DeStress was originally funded by the Engineering and Physical Sciences Research Council (EP/R003467/1), and hosted at Heriot-Watt University. It is now hosted at the University of Surrey [www.DeStress.surrey.ac.uk](http://www.DeStress.surrey.ac.uk).

**Further reading**

Payne, S.R. and Bruce, N. (2019). Exploring the Relationship between Urban Quiet Areas and Perceived Restorative Benefits. *International Journal of Environmental Research and Public Health*, 16(9), 1611. <https://doi.org/10.3390/ijerph16091611>

**Case Study 6**

*Safe and Sound Project – Artificial warning Sounds for Electric Scooters*

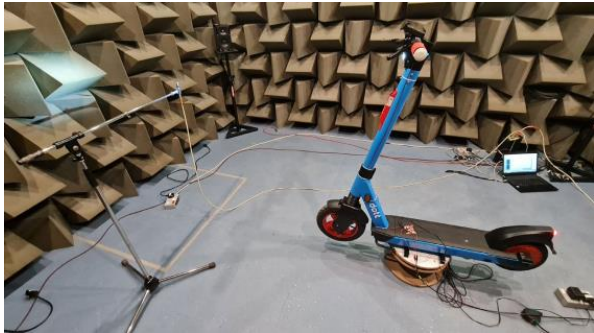


Figure 6: Case Study 6 – Safe and Sound Project

### Summary:

Electric scooters (e-scooters) are becoming an increasingly common sight on our streets, with an estimated 520,000 shared e-scooters across Europe as of 2022. Although electric micromobility, such as e-scooters, offer a range of societal benefits including reduced pollution and increased personal mobility, concerns have been raised regarding the implications for pedestrian safety, most notably within the blind and partially sighted community. These concerns are backed by statistics which show an increasing number of collisions involving e-scooters and pedestrians as they become more common place on our streets.

The goal of the Safe and Sound Project was to develop a stand-alone Acoustic Vehicle Alerting System (AVAS) for e-scooters. When considering the development of AVAS sounds, the precepts of 'detectability' and 'annoyance' are often considered, and previous research has shown how specific acoustic features (e.g. pitch, amplitude modulation, number of harmonics) influence these judgments. In their research at the University of Salford, the researchers built on this previous work by considering the development of AVAS for e-scooters, so as to increase their detectability whilst minimising annoyance.

To assess the performance of a set of AVAS sounds designed for high detectability and low annoyance, a Virtual Reality (VR) experiment has been completed between December 2022 and February 2023. Wearing a VR headset, participants were immersed into a 360 degree environment, featuring simulations of e-scooter riders in different scenarios. Working with RNIB, a group of people, including blind and partially sighted, was asked to identify when they are first aware of the e-scooter, and provide feedback on the suitability and preference of the AVAS sounds presented. The tests took place in a listening room in the University of Salford's Acoustics Research Centre, and then was repeated in London (in collaboration with RNIB); and Rome, Stockholm and Madrid in collaboration with blind associations across Europe. The trials in different countries ensured international relevance with the aim of creating a global standard for an e-scooter sound.

Following the VR experiments, the sounds were also tested in June 2023 in a series of field trials carried out at the University of Salford's campus, to validate the laboratory setting findings.

The project was by University of Salford's Acoustic Research Centre led by:  
Principal Investigator: Dr Antonio J Torija Martinez, Associate Professor in Acoustic Engineering  
Researcher: Dr Tim Walton, Research Fellow in Acoustics and Audio Engineering

### Funding

The Safe and Sound project is funded by the University of Salford's Higher Education Innovation Fund and emTransit B.V (Dott).

### Further reading

[Report Dott HEIF-project Final.pdf \(salford.ac.uk\)](#)

Torija Martinez, AJ, Elliott, AS, Harris, LE, Podwinska, ZM, Welham, CJ, Nicholls, RK, Steer, B and Williams, DAH 2021, Generation and analysis of artificial warning sounds for electric scooters, Project Report, University of Salford. Link: [https://usir.salford.ac.uk/id/eprint/63464/1/Report\\_Dott\\_HEIF-project\\_Final.pdf](https://usir.salford.ac.uk/id/eprint/63464/1/Report_Dott_HEIF-project_Final.pdf)

Walton, T., Torija, A. J., & Elliott, A. S. (2022). Development of electric scooter alerting sounds using psychoacoustical metrics. *Applied Acoustics*, 201, 109136. Link: <https://doi.org/10.1016/j.apacoust.2022.109136>

### Case Study 7

#### *Enhanced Green routes, Bristol 2022*

Bristol City Council's transport engagement team commissioned Tranquil City, an environmental data company, and Go Jauntly, a walking app, to explore how a bespoke 'Green Routes' app feature could encourage healthier and more sustainable walking journeys. The app feature offers citizens of Bristol alternative routing options calculated using multiple environmental quality benefits, including greener, quieter, less polluted and more appealing journeys. It embeds a soundscape and place-based approach to creating journey routes, allowing users to find more restorative soundscapes in the city. The hypothesis is that by providing an improved journey soundscape, users were more likely to choose to walk their regular urban trips, and will improve their mood, stress levels and self-reported wellbeing.

The project was designed to assess how the intervention contributed towards global and city-specific performance metrics, such as the United Nations' Sustainable Development Goals 'Good Health & Wellbeing' (3) and 'Sustainable Cities & Communities' (11) plus Bristol Corporate Strategy 2022-2027 'Support Safe and Active Travel' (TC3) and 'Mental Health & Wellbeing' (HCW2).

To calculate the 'Green Routes', a city-wide soundscape mapping exercise was undertaken, bringing together Defra strategic noise maps, alongside other urban and green infrastructure, and environmental data layers (such as Air Quality), to create the Tranquil City Index. The Tranquil City Index is an evidenced-based geospatial data layer that highlights the potential for a location/street to be good for wellbeing and mental restoration. This combines evidence on what elements contribute and detract from mental restoration based on empirical evidence guided on by Environmental Psychologist Eleanor Ratcliffe of the University of Surrey. To create the data layers and ensure they were up-to-date, a Machine Learning model referenced hundreds of data layers to create predictions for data layers that were not available in Bristol and were validated using random point location analysis and on-site assessments.

The Tranquil City Index dataset was then integrated into the Go Jauntly routing algorithm and tuned to balance various other aspects including as providing a reasonable trip length.

The impact of the app feature was measured using a combination of public stakeholder engagement, in-app usage and environmental and health benefit calculations. Two workshops were conducted in June 2022 to explore the public's perspectives on the feature in Barton Hill and Filwood, two inner city areas with higher-than-average levels of health deprivation.

The findings of the project were that the Green Routes app feature provided routes that had on average 15% more greenery and spent 20% more time in quiet areas. 50% of participants felt happier and 70% felt more relaxed after taking the green route than the fast route. Attitudes towards the routes showed that offering greener alternatives could increase likelihood of choosing walking by 36% and 80% of participants found the green routes offered a quieter, less polluted experience. If scaled to the

entire Bristol population, predictions indicate that it could increase time spent in nature by 2.9 million hours, significantly reduce pollution emissions and reduce carbon emission by 50,000 tons.

This pilot study demonstrates the opportunity and benefits of providing a soundscape approach that considers not only reduction in noise levels, but the addition of contextual elements that affect sound perception and experience. It demonstrated that greener, quieter and better sounding, less polluted routes encouraged walking and improved mood and self-reported wellbeing. Further trials are due to be conducted in other UK cities in 2023.

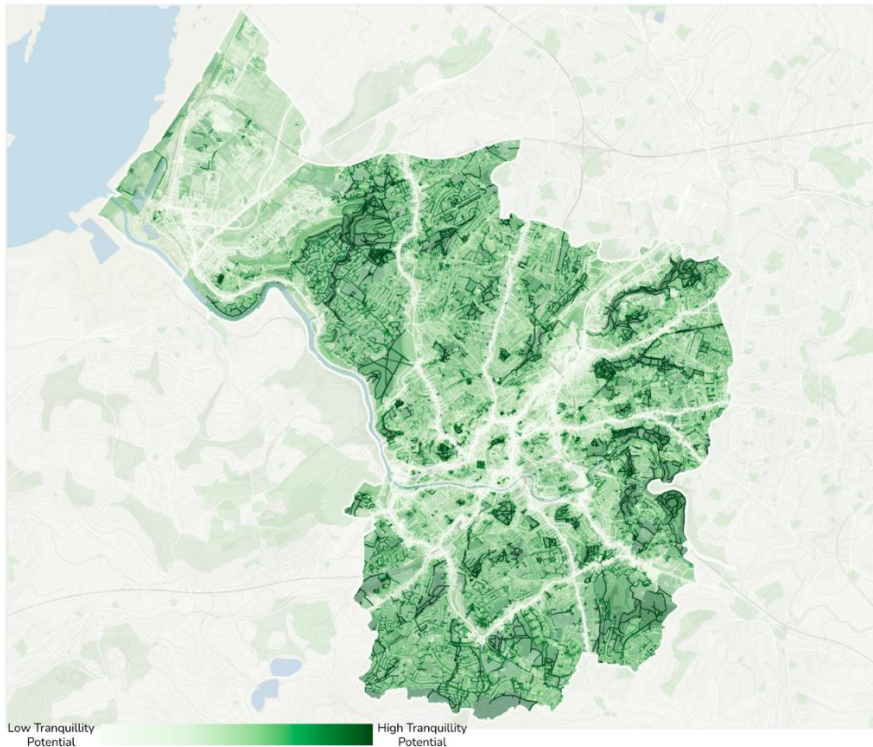


Figure 7: Case Study 7 - Tranquil City Index (Bristol). The Tranquil City Index is based on empirical evidence links between subjective wellbeing (e.g. happiness and anxiety) and key environmental properties of green and blue space, land use, noise, and air quality.

**Further reading**

Enhanced Green Routes Project Report (2022) – Link: <https://drive.google.com/file/d/1iF-zAxUB8YTIQEBXqQ0xDZCSO22Ezk-F/view>

The project was a collaboration between Grant Waters of Tranquil City, Eleanor Ratcliffe of University of Surrey and a team from Go Jauntly.

**Case Study 8**

*The Natural Tranquillity Method: Examples in Ipswich, Norfolk Broads and West End London*

Work by Clive Bentley of Sharps Acoustics.

Based on research between 2015 and 2019 Clive Bentley developed a prediction method called the Natural Tranquil Method (NTM) on four factors:

- Overall level of sound
- Amount of road and rail nearby
- Relative levels of natural and manmade sound other than road and rail
- Percentage of time can hear natural sound



This provides an objective way to assess tranquillity and has been used on a number of notable projects, including the impact of construction noise on the tranquillity of the East Coast and Heath's ANOB. Another example was considering the impacts (positive and negative) on tranquillity of two bypass road schemes in Norfolk. The third example was an urban park in Ipswich, which an example map is show below.

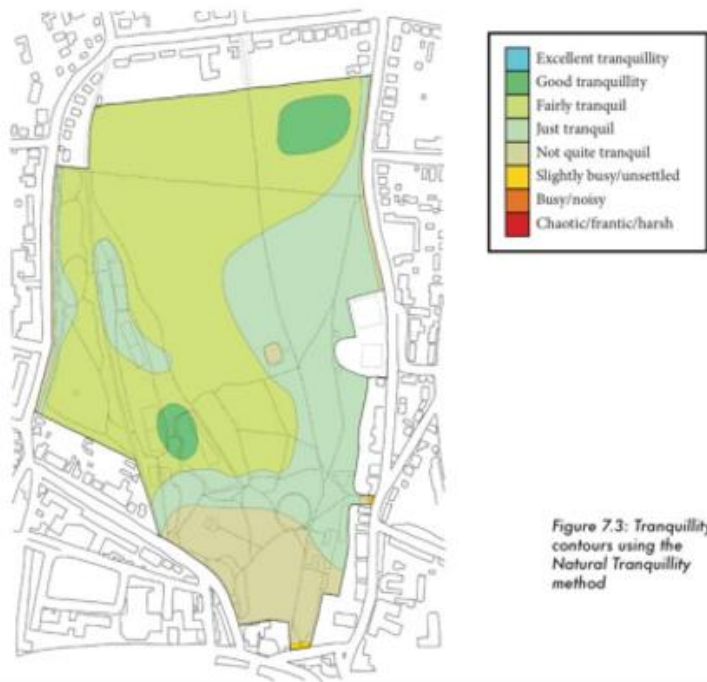


Figure 8 : Case Study 8 – Sample Tranquillity map for an urban park in Christchurch Park, Ipswich using the NTM.

### Further reading

The method is set out in a book called “Tranquil Spaces” (2019), by Clive Bentley.

### Case study 9

#### *Soundscape design for a co-housing development in Newcastle upon Tyne*

This case study by Apex Acoustics Ltd. used a soundscape approach to a proposed co-housing development called CoHUT in Newcastle upon Tyne, UK (see further reading) The 25-unit development is arranged around a central courtyard, located near busy roads.

In-situ soundwalks were conducted with future residents during daytime and night-time covering areas with varied soundscapes. Binaural audio recordings were made and used to create a virtual soundwalk with external and internal scenes. Questionnaires based on ISO 12913 were used to collect perceptual responses. A virtual sound walk was created, which can be viewed here.

The process revealed aspects of the acoustic environment not captured by standard noise metrics. For instance, night-time soundwalks showed different perceptual ratings between locations despite similar noise levels, likely due to the intermittent nature of nearby traffic. Analyzing perceptual attributes and sound sources helped inform design improvements, like better enclosing the courtyard and planting to encourage birds as sources of natural sounds.

The soundscape approach enabled a co-creation process, with future residents identifying positive sound elements and proposing optimal uses for external amenity areas. Challenges included translating outcomes into specific design goals, determining inclusivity between varied responses,

and the resources required compared to a traditional noise assessment. Overall the study demonstrated the potential for soundscape methods to improve residential design.

The site location and architect’s visualisation of the development (viewed from the NE) are shown in the soundscape assessment figure 9b below, with the parameters mapped for nighttime near the façade [1 - blue] and in the outside amenity space [3 - purple]. The proximity of the road makes the intermittent traffic feel more intrusive. This is especially true during the night-time, when the background sound levels are lower.



Figure 9a): Case Study 9 – render of proposed scheme

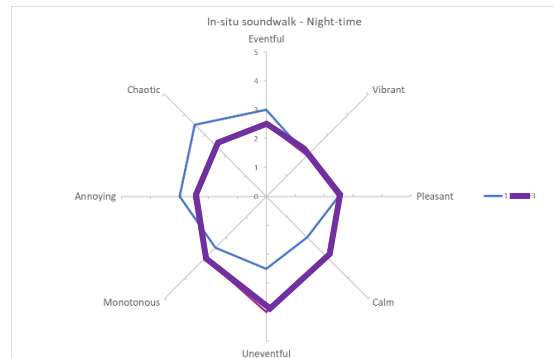


Figure 9b) : Case Study 9 – Night time soundscape

### Further Reading

Sajeev, S., Romeo Pitone, R., Nabialek, D., Batten, J., Harvie-Clark, J. “Soundscape design for a residential development: a case study.” Proc Inter-Noise22, Glasgow. [https://doi.org/10.3397/IN\\_2022\\_0439](https://doi.org/10.3397/IN_2022_0439)

Project led by J., Harvie-Clark.

## 5 CONCLUSIONS & RECOMMENDATIONS

The scientifically supported evidence base now exists to support sound being part of benefiting species health and wellbeing through a soundscape approach, offering an alternative to dealing only with the negative impacts on health by noise pollution. The largest advances have been achieved by the corpus of academic work, but what is lacking is practical application of this knowledge to real life examples. Case studies are included to illustrate some ways in which this has been done and to encourage further work.

Things are indeed accelerating in the UK, with the Welsh Government is now working to pass legislation that names Soundscape on the face of the Bill <sup>38</sup> - and if approved, the Act would then place a duty on Welsh Ministers to:

- promote awareness of air pollution;
- place a duty on Welsh Ministers to publish a national soundscape strategy, and
- give the Welsh Ministers a power to amend existing legislation relating to noise.

By including soundscapes within the proposals in the Bill, Welsh Ministers are delivering on their objective to create and pursue any opportunities to further align noise, soundscape and air quality policy. Wales will be the first part of the UK to include soundscape in legislation.

The use of sound to create positive and healthy soundscapes is an area which the UK Government are recommended to consider in light of this corpus of evidence, the role of Soundscape in future good acoustic design, planning and strategic as a part of integrated sustainable development that focuses on restorative environments. It is also recommended by the UK soundscape community, including the authors, that this paper is considered alongside the HOL report, which is limited to the negative effects of noise pollution on human health.



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