

Environmental Noise Pollution

1.1 DEBATES AND CHALLENGES

A recent article in the *New York Times* came with an intriguing headline: ‘Behind city’s painful din, culprits high and low’ ([Buckley, 2013](#)). The painful din that is described is the seemingly inescapable background and impulsive noise embedded within major world cities such as New York. As for the culprits – they are the producers of noise being emitted from the very depths below the ground to the skies overhead and seemingly everywhere in between. In the article, the author describes the everyday subjugation of New Yorkers to various sources of environmental noise – road and rail traffic noise, nightly construction activity (underground and over ground), helicopters and airplanes, bars and nightclubs, police and emergency sirens, among others. But more importantly, the piece describes the human experiences of excessive noise – how it actually affects people’s everyday lives. Because very often the human impact of environmental noise gets lost in the technical detail: the noise indicators, the decibel scale, the modelling and measurement procedures. The detail is, of course, very important. In fact, it is crucial for understanding and assessing noise pollution as a public health problem. But emphasising only the technical nature of the problem risks normalising noise pollution as an abstract, stoical and somewhat inaccessible experience even though we know it is often viewed as a personal affront to the people being subjected to it. Rather than noise being an abstract notion then, almost everyone has an intuitive understanding of what it is because we all experience it on a daily basis. In fact, the manifestation of noise exposure as emotion in humans is incredibly subjective even though the physiological impacts are broadly similar. We know from scholarship that human sensitivity to noise is variable – two people exposed to the same sound pressure level can have quite different subjective reactions in terms of their annoyance levels and associated psychological effects. Therefore, understanding

the variable ways in which noise affects its human recipients is a vital accompaniment to technical understanding and problem solving for noise pollution problems.

New York is not exclusive in having a noise problem; rather, it is quite a typical example of the sound environment of modern cities. While European cities are perceived as being somewhat quieter than North American cities, rapid urbanisation and the increased concentration of human settlement and associated activity across relatively small areas typically lends itself to noisier environments. And it is a problem that has plagued cities, in particular, for centuries. Often cited in the literature is the fact that Julius Caesar banned chariots from the streets of Rome during the night because citizens could not sleep. However, it is the Greeks who are credited with the first noise abatement ordinance: in the first century B.C., they banned potters and tinsmiths, as well as roosters, from residential areas of their cities (Goldsmith, 2012). Even in New York, a relatively young city, the fight against noise has been ongoing for over a hundred years. During the Constitutional Convention in Philadelphia (1787) which resulted in the U.S. Constitution, dirt and straw were used to cover the cobblestone streets in front of Pennsylvania State House in an effort to reduce noise levels. In New York (1905), the *New York Times* decried the 'Trolley cars, boiler making, elevated roads, subway trains, harbor sirens, and various steam whistles, riveting machines, trucks laden with slabs of iron and rails of steel, milk wagons banging over the pavements in the small morning hours, hand organs, phonographs with megaphone attachment, fish horns, knife-grinding serenades, yelling junkmen, hucksters and peddlers with cowbell distractions, cracked bells ringing day and night in churches and chapels'.¹ In response to the problem, Julia Barnett Rice founded the Society for the Suppression of Unnecessary Noise in 1906 and this body was largely responsible for the signing into law of New York's first piece of noise abatement legislation prohibiting steam-boat captains from unnecessarily sounding their whistles.

In today's cities, the characteristics of the noise have changed with changes in the structure of the economy together with technological change that has been both a force for quieter and noisier cities simultaneously. No longer have we steam whistles or boiler making but these have been replaced by alternative sources of noise such as cars and motorcycles with wider tyres and high-powered engines. The history of noise is not simply a case of being quieter in the past and louder in the present – that is far too simplistic. Noise has always been a problem, particularly for cities. But there is certainly some truth to the suggestion that noise is the forgotten environmental problem. Given its history, there is little doubt

¹'The noisiest city on Earth', *New York Times*, 2 July 1905.

that it has not been tackled with the same vigour as other environmental pollutants (e.g. air pollution) but the reasons for this are not entirely obvious.

So we can clearly see that noise pollution is an age-old problem that has a tendency to come full circle. In other words, we are still discussing many of the same issues and problems today in relation to its prevalence that were discussed hundreds and even thousands of years ago. So while the character of the noise problem has altered with changing technological and cultural norms, its essence remains largely the same. The crucial difference between modern societies and those of the past is that noise pollution now affects a greater proportion of the population primarily because more people now live in cities than at any time in our previous history and cities are notorious noise hotspots. The challenge then for acousticians, environmental scientists, epidemiologists, planners and policymakers is to collectively understand the impacts of environmental noise on humans and simultaneously figure out ways to control its excess. Indeed, unless steps are taken to curb noise pollution, there is little doubt that its impact will increase at least at the rate of urbanisation. But it would be wrong to think that noise is an environmental problem that is exclusive to cities. It is one that reaches out beyond urban limits and into the countryside affecting rural dwellers also. Thus, the need to assuage the impact of noise pollution should not be confined to urban areas; rather, strategies that aim towards noise mitigation must also encompass noise hotspots beyond core city-regions.

1.2 ENVIRONMENTAL NOISE

Definitions can sometimes be uncomfortable for scholars. In many respects, this is because scientists do not always like to set definitional boundaries on a concept or phenomenon that does not necessarily fit with definitional rigidity. Environmental noise is one of those concepts, largely due to the fact that the characterisation of sound as noise is quite subjective depending on the individual being exposed. Nevertheless, it is important for the reader to have a working definition that acts as a reference point for the focus upon which this book is based. It is also important for governments, national and supranational organisations who strive to reduce noise; definitions determine how noise is assessed, regulated and mitigated as an environmental problem. In other words, how it is defined places boundaries around how to control noise as a pollutant. In this sense, it gives people and policymakers a target to agree on, debate and attempt to control. And definitions of environmental noise do vary somewhat in the literature. While the differences are not extreme, it is important to note

that they do exist. Certainly, there are some quite distinct variations in how *noise* and *environmental noise* are defined.

Noise is generally referred to as unwanted sound that can negatively disrupt human or animal life. Goldsmith (2012) has recently taken issue with that definition arguing that such a definition leaves open the possibility that some sounds could be unwanted simply for what they signify rather than the sound being unwanted in itself (e.g. the voice of an enemy). This demonstrates the contested nature of how noise is defined. And we can never completely agree on what noise is: a rock concert can be a musical nirvana to some ears but an unbearable racket to others. He suggests an alternative based on the physicist George William Clarkson Kaye's 1931 definition of noise as 'sound out of place'. It is sound that is unwanted, inappropriate, interfering, distracting and irritating (Henry, 2013).

Environmental noise, on the other hand, has been defined as any unwanted sound created by human activities that is considered harmful or detrimental to human health and quality of life (Murphy et al., 2009). Specifically, environmental noise refers only to noise affecting humans and is concerned exclusively with outdoor sound caused generally by transport, industry and recreational activities. Thus, environmental noise is a form of pollution. And this classification is quite useful because it means that confronting noise becomes quite intuitive. By way of definition, pollution is something that is to be avoided, controlled, regulated or eliminated because of its negative impact on humans and human-environment relations.

1.3 THE BOOK'S FOCUS AND RAISON D'ÊTRE

The foregoing discussion leads to an obvious question about the nature of the contribution of this book. There have been many contributions to the noise literature over the last decade. These contributions have ranged from more technical aspects of noise and the prevailing sound environment (Kang, 2007) to more recent contributions on the sensory history of noise (Goldsmith, 2012), and its social history and usage (Henry, 2013). The focus of this book is not on sound *per se* but on a subset of sound – environmental noise. And there have been surprisingly few titles that explore issues around environmental noise. This is somewhat unexpected given that there seems to be more awareness and attention not only among policymakers about noise pollution issues but also among the general public who are much more educated and indeed exercised to action about noise pollution issues in their local communities than in the recent past.

This book then offers something different from previous contributions in that it is focussed exclusively on environmental noise pollution. That is, noise in the environment that is considered out of place which affects

humans negatively and is classified as a pollutant. Having said this, we are conscious of the rich and varying history of sound and its interpretation as noise. We acknowledge that a Harley Davidson motorcycle might be a frightful noise for some people but an exhilarating sound to those who drive them.² And while we recognise that, as in the previous example, the characterisation of sound as noise is often subjective, we take the view that the subjective views of a single individual or a small minority are acceptable only insofar as the emission of that sound does not infringe on the rights of others to an environment that is relatively free from noise-induced annoyance and disturbance.

Thus, this book is concerned in the first instance about the nature of the relationship between environmental noise and humans, specifically within the context of the health effects of environmental noise. That is the issue of crucial import for this book – environmental noise has been found to negatively affect human health. And these health effects are highly concentrated spatially with cities being the hotspots for noise-induced health effects. Therein, the primary sources are noise from the use of transportation infrastructure such as roads, railways, airports as well as from industrial sources. While we acknowledge that there are indeed other sources of environmental noise in cities and beyond, this book has the aforementioned sources as its fundamental focus. And there are good reasons for this; in the EU alone, somewhere in the region of 50 million people are exposed to night-time noise above 50 dB(A) from these sources within city-regions with a further 28 million exposed beyond these areas. While these figures are EU specific, they generalise for the vast majority of nations around the world. In fact, they are likely to be significantly worse in developing world cities where noise pollution is often not even considered to be an environmental problem. Given that the World Health Organization (WHO) sets 40 dB(A) night-time as the value above which health effects are noticeable in humans, the exposure figures point to the seriousness of excessive exposure to environmental noise as a major problem throughout the world.

Understanding the relationship between noise and human health confers a responsibility on scholars, acoustics/environmental practitioners and students to understand not only its sources but ultimately how it is transmitted to the receiver, i.e., a human subject. In this regard, the book focuses on how noise sources can be understood and assessed through a range of modelling and measurement procedures which are often source and indeed nation specific. While the book is principle-based and offers a geographically diverse view of environmental noise issues from around the world, it does

²In fact, Harley Davidson filed a sound trademark application for its distinctive V-twin engine sound in 1994, indicating the extent to which sound can be used to brand consumer products.

place emphasis on developments in the European Union. The reasons for this are quite logical: the EU leads the world in terms of its approach to understanding, modelling, assessing and mitigating environmental noise. It has, by some way, the most progressive and large-scale noise assessment policy in the world. Moreover, it is a policy which has a basis in environmental law though Directive 2002/49/EC, also known as the Environmental Noise Directive. For that reason, we focus on the principles employed by the EU's mandatory strategic noise mapping and action planning process as a way of illustrating best practice that can be adopted and translated across jurisdictions beyond Europe. We also focus on how noise can be mitigated at its source and through propagation-based abatement measures but also by focussing on holistic strategies which include raising education and awareness about environmental noise as an environmental and public health problem. So while a good portion of the discussion has a European focus, the principles outlined and the issues faced are, in our view, universal; they can be applied to almost anywhere in the world. After all, noise is, and always has been, a worldwide issue.

The book then is structured in such a way as to outline the fundamental principles and concepts of environmental noise – its technical characteristics and properties, how it is measured and modelled and how it propagates outdoors in [Chapter 2](#). This acts as the starting point for further discussion and exploration of environmental noise as a pollutant and provides the technical background that is essential for the accessibility and understanding of subsequent chapters. [Chapter 3](#) offers a state-of-the-art review of the existing evidence base for the health effects of environmental noise on humans. Essentially, this is the most fundamental reason why environmental noise is considered a pollutant that needs to be avoided, controlled and mitigated against. [Chapter 4](#) provides an outline of the strategic noise mapping process concentrating on its key principles and processes. This is provided as essential context for the discussion of noise sources in the following two chapters. [Chapter 5](#) is somewhat more technical in nature and deals with sources of transportation noise and how the source and propagation characteristics are modelled. In [Chapter 6](#), similar attention is given to sources of industrial noise while the modelling and measurement of other sources such as wind farm noise is considered. [Chapter 7](#) concentrates on technical and pragmatic approaches for noise mitigation. This includes a detailed account of measures for noise mitigation at the source and measures to limit noise propagation at the point of the receiver. The principles associated with noise action planning as an approach to noise mitigation are also discussed in detail. The final chapter – [Chapter 8](#) – offers some broad ranging reflections on existing and future approaches for environmental noise mitigation. It also focuses on emerging technical developments in noise modelling and measurement as well as some suggestions for improving environmental noise policy and legislation.

References

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