
A Review of Progress in Soundscapes and an Approach to Soundscape Planning

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The soundscape approach considers the acoustic environment as a resource, focusing on sounds people want or prefer. Quiet is not a core requirement for such acoustic preference in the outdoor acoustic environment. Core requirements include congruent soundscape and landscape, and dominant wanted sounds in a place over, and not masked by, unwanted sounds. Acceptance, and further development, of the soundscape approach is facilitated by distinguishing it, both conceptually and in measurement and management approaches, from environmental noise management. Soundscape design, planning, and management, based on soundscape concepts, augment environmental noise management approaches, expanding the scope of application of the tools of acoustic specialists.

1. INTRODUCTION

The term *soundscape*, in the couple of decades since popularised by Schafer¹ and others, has had a range of applications. It has encompassed the recordings of the sounds of nature; compositions based on, or of, natural sounds; studies of the sounds heard in villages and rural environments; analysis of the way acoustic environments have been described in history and in literature; analysis and description of all types of acoustic environments; and the creation of artistic sound installations.²

While cognizant of these different applications of the term, this paper has a specific focus on soundscapes as applied to the management, planning, and design of the acoustic environment—primarily, but not exclusively, the acoustic environment of outdoor space. The established field of environmental noise management also deals with the acoustic environment of outdoor space, and clearly there are linkages and necessary distinctions between the two approaches, and these will be discussed further below. A current tendency towards a devaluation of the term *soundscape* by its use as a synonym for *community noise* would best be avoided. A community noise survey, for example, is not a *soundscape survey*; nor is a map of urban noise a *soundscape map*.

The field of soundscapes intersects, to various degrees, with fields of acoustics such as sound quality, human acoustic comfort in buildings, and music—and also with nonacoustic fields such as wilderness and recreation management, urban and housing design, and landscape planning and management. Soundscapes involve diverse fields of practice, approaches, and disciplinary interests (see, for examples, reviews by Hiramatsu of soundscape studies in Japan³ and Lercher and Schulte-Fortkamp.⁴

2. SOUNDSCAPE IS PERCEPTION OF THE ACOUSTIC ENVIRONMENT OF A PLACE

Central to the term soundscape is an individual's, or society's, perception and understanding of the acoustic en-

vironment.^{5–12} Thus, a soundscape exists through human perception—but always within the context of a particular time, place, and activity. The *acoustic environment as perceived and understood, by people, in context*, is a definition of soundscape that may be adopted in a future acoustic standard.¹³ This perceptual construct of the soundscape allows it to be applied, not just to a place as it is experienced, but also to a place in memory¹⁴ or even to abstract constructions such as musical compositions² or sound installations. Herranz-Pascaul et al.¹⁵ provide a good theoretical person-place-activity model—firmly rooted in the psychological process of environmental experience—through which to understand and research soundscapes.

Various authors have drawn the useful analogy of soundscape as the auditory equivalent of landscape.^{1,7,11,14,16,17} The European Landscape Convention Agreements¹⁸ define *landscape* as “an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors”. This is a good basis for an analogous soundscape definition. Substituting *place* for *area* because of the high spatial variability of the acoustic environment over any area, a useful definition of soundscape is obtained: *soundscape is the acoustic environment of a place, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors*. The Convention goes on to define *landscape policy*, *landscape planning*, and *landscape management*. Again by analogy, this usefully leads to the definition of *soundscape policy* as the expression by the competent public authorities of general principles, strategies, and guidelines aimed at the protection, management, and planning of soundscapes—and similarly to *soundscape management* and *soundscape planning*.

While the soundscape of a place is thus a perceived entity, soundscape management, soundscape planning, or soundscape design aim at management or manipulation of the acoustic environment of a place to change the way that its acoustic environment is perceived by humans. The soundscape is perceived in a physical, often outdoor area/space/location, and that place also has certain visual and other properties associated with its

natural, or human-made environment. The acoustic environment of that place can be described by acoustical parameters such as type of sound sources, levels, spectrum, and temporal pattern. The place is also where people live or occasionally spend time and perform activities, and in which people interact with the physical environment and with each other. These contexts in which the acoustic environment is experienced (person-place-activity) is critical to soundscape perception.

The acoustic and the visual (and other) components interact in human perception.¹⁹ Interpretations of the term *soundscape* have been as diverse as those of its namesake *landscape*. For example, soundscape has been interpreted as geographical form, a system of physical components, both determinant and reflection of culture (painting, literature, and music), a focus of recreational activity, and a design activity as in planning or urban design.

3. INSTITUTIONAL INTEREST IN SOUNDSCAPES

There is increasing interest in the soundscape concept. This includes:

- the European Environmental Noise Directive and its reference to *areas where noise quality is good*—resulting in attempts to define and map areas of *quiet*;
- *natural quiet* in national parks in the USA;
- work on a draft soundscape standard;
- the COST Activity on soundscapes; and
- various projects such as the Swedish *Soundscape Support to Health*, and French Ministry of Town Planning housing and construction projects.

3.1. The Environmental Noise Directive and Quiet Areas

The primary thrust of the European Environmental Noise Directive (END) [Council Directive (EC) 2002/49/EC] has been in reducing noise exposure where it can induce harmful effects on human health. However, the END also refers to places such as *public parks or other quiet areas in an agglomeration and quiet areas in open country*. This requirement for identification of *quiet areas* is a recognition that the acoustic environment has relevance for humans other than harmful effects. There have been various attempts to define and map quiet areas in Europe.²⁰ A review of available guidance on defining quiet areas²¹ found that, while most definitions were currently based on specifying limit value of some energy-integrative measure (L_{den} , L_{eq} etc.), with limits ranging from 40 to 55 dB, there was too little research information available to allow the identification of quiet areas purely on the basis of acoustical criteria. As will be demonstrated below, the notion of *quiet* may have only limited application in defining high quality soundscapes.

3.2. Soundscapes in Public Lands in the US

There has been some intersection of noise and soundscape approaches in investigations of the acoustic experiences of recreationists in the wilderness.^{16,22} The term *natural quiet* (defined²³ as “. . . *the absence of mechanical noise, but containing the sounds of nature, such as wind, streams, and wildlife, as well as visitor-generated self-noise. . .*”) has been applied to the management of national parks and forest lands in the US. The term appears to have had considerable utility in developing the concept of the soundscape as a resource that requires management in the contexts of wilderness and recreation on public lands. It is suggested²⁴ that visitors to these areas have a clear and widely shared understanding of the concept, though the technical complexities of characterizing and assessing these soundscapes are significant. Natural quiet, interpreted as the absence of certain human-generated sounds, means that the latter should not be audible above the natural sounds—effectively an audibility criterion, but more pragmatically, this has evolved into a percent-time-audible or a percent-time-above concept, where the human-generated sounds should not be audible above the natural sounds for some specified percentage of a period of interest.^{25,26} Natural quiet does not mean silence,²⁷ and there is a range of expressions²⁶ that are considered similar: *natural sound environment*, *natural sounds*, *natural ambient* and *natural soundscape*. A recent edition of *Park Science* by the National Parks Service²⁸ describes both the evolution of soundscapes as a management concern for the Service and the growing body of research, in terms of the nature of soundscapes in parks, sound-based conflicts both for visitors and wildlife (i.e., from external transport sources or generated by visitors themselves), and management approaches.

3.3. Work on Standardization

The increasing interest in soundscape approaches to the acoustic environment has led to the need for some standardization, at least in terminology and in minimum reporting requirements in soundscape assessments and studies. Work is proceeding with the International Organization for Standardization (ISO) on what may become a series of standards on the conceptualization, evaluation, and application of soundscape ideas. In 2008, a Working Group of ISO/TC 43/SC 1 was established to begin consideration of a standardized method for assessment of soundscape quality outdoors—such assessment being seen as not just a question of presence or absence of annoying sounds, but the positive aspects of sound environments as perceived by people. Matters that could be considered for standardization included methodology, questionnaire protocols, identification of sounds heard as part of the soundscape, ratings of human overall preference and of various perceptual dimensions of the soundscape, together with essential information to be recorded on the setting and on human activity.¹³

3.4. The COST Action on Soundscapes

Further international cooperation in soundscapes is occurring through the European COST *Network on Soundscape of European Cities and Landscapes*. The Action now has over

30 participants including seven partners outside Europe: USA, Canada, Australia, Japan, Korea, Hong Kong, and China. The network covers many disciplinary areas: acoustical, social, psychological, physiological, linguistic, historical and architectural. The main aim of the network is to provide the underpinning science for soundscape research and to assist in moving the field beyond the current state-of-the-art by harmonizing research methodologies so that studies across the world can be compared and contrasted. This comparison would avoid duplication of work, and encourage multisectoral collaboration, not only between researchers, but with practitioners and policy makers too. The COST Action also will attempt to promote soundscape into current legislations, policies, and practice, aimed at improving/preserving our acoustic environment. The focus of the COST Network is on

Understanding and exchanging:

- Fostering interdisciplinary exchanges;
- Exchanging technical know-how on an international/interdisciplinary basis; and
- Examining cultural differences.

Collecting and documenting:

- Gathering soundscape data to be reanalyzed from interdisciplinary perspectives.

Harmonizing:

- Reviewing and harmonizing current methodology;
- Developing a standard protocol; and
- Laying the foundations for future European/international standards.

Creating and designing:

- Providing practical guidance and tools for the design of soundscapes; and
- Providing guidelines for preserving architectural heritage sites.

Outreaching and training:

- Creating awareness among general public, stakeholders, and policy makers; and
- Providing training for early-stage researchers.

4. DIFFERENT FOCI OF SOUNDSCAPES AND ENVIRONMENTAL NOISE MANAGEMENT

Truax²⁹ describes two distinct approaches to the external acoustic environment: the *traditional, objective, energy-based model of the acoustic environment* (environmental noise management) and the *subjective listener-centred model* (soundscape approach), and argues that an integrated model is required. How the two fields differ, and how they extend and complement each other, warrants further examination. The different foci of the two approaches are shown in Table 1.³⁰

Table 1. The different foci of environmental noise and soundscape approaches.

Environmental Noise Management Approach	Soundscape Approach
sound managed as a waste	sound perceived as a resource
focus is on <i>sounds of discomfort</i>	focus is on <i>sounds of preference</i>

Sound is conceived as a waste product in the environmental noise field—a waste to be reduced and managed. Such noise reduction or management is at the source, in the propagation path, or at the receiver itself. Brown³⁰ suggests that, in contrast; “...the soundscape field regards sound largely as a resource—with the same management intent as in other scarce resources such as water, air and soil: rational utilization, and protection and enhancement where appropriate. Resource management has a particular focus on the usefulness of a resource to humans and its contribution to the quality of life for both present and future generations.”

Another essential distinction between the two fields is the human outcome of interest. By and large, environmental noise deals with adverse outcomes for people—or *sounds of discomfort*³¹ (e.g., any or all of the effects of sleep disturbance, annoyance, adverse physiological effects, interruption to communication, etc.). The focus in soundscape studies tends mostly to be on *sounds of preference*. Preference is considered within building acoustics as preferred ambient levels for rooms, preferred reverberation time in halls for speech and music, and for products in terms of their sound quality. It has had little use in environmental acoustics, though Genuit³² has suggested that sound quality concepts should also have environmental/soundscape application. It is sometimes suggested that the fundamental distinction between the soundscape field and the environmental noise field is the soundscape field’s focus on human perception, but much work in environmental noise is also perceptually based as in the measurement of annoyance. The real distinction between the two fields is the different human outcomes of interest.³⁰

5. PREFERENCE FOR WHAT OUTCOME?

Soundscapes may be studied intrinsically, examining the systematic relationship between humans and the acoustic environment (*soundscape ecology*⁶), but much work also deals specifically with human preference for different soundscapes, or human acoustic comfort.⁹ Objectives include the creation, or improvement, of the soundscape of a place (*soundscape planning or design*) or its management. Table 2 lists a wide variety of potential outcomes that could be associated with human soundscape assessment.

In different places and in different contexts, a person’s preferred outcome with respect to the acoustic environment is likely to differ. For example, a soundscape might be preferred because it is peaceful or tranquil, but another because it is lively, or varied, or creates a sense of excitement. Yet again, preference may be for a soundscape that provides information, clarity, and conveys safety. In another place or context, preference may be for hearing soundmarks¹—a soundscape that has unique cultural or natural characteristics. Even for the one person in the same place, change in the context—say in

Table 2. Different outcomes which might determine preference for the soundscape in different places and contexts (from Brown et al.)³³

acceptability	identification of place	relaxation
appropriateness	importance	safety
clarity	information	satisfaction
comfort	liveliness	sense of control
communication	naturalness	solitude
enjoyment	nature appreciation	tranquility
excitement	nostalgic attachment	uniqueness
happiness	peacefulness	variety
harmony	place attachment	well-being

the activities being undertaken—may result in a preference for a different outcome, as the model of Herranz-Pascaul et al.¹⁵ suggests.

It has been noted³³ that there is a need to distinguish between *direct outcomes* and *indirect* or *enabled outcomes*. Direct outcomes are those where the person is largely aware of the sounds around them, and can consciously attribute the particular outcome directly to the soundscape. However, the soundscape of a place may enable certain outcomes/activities—people know that a place is a good one in which to play with children, or in which to relax, or to meet with people, or to communicate—without their dissecting exactly why it is that the environment of a place provides so well for that activity. Outcomes in such places may thus be facilitated or enabled by the soundscape.

5.1. Wanted Sounds—Sounds of Preference

What sounds do people want or prefer? The answer depends entirely on the contexts of place, time, and activity and on who is doing the listening.^{15,33} It will vary between groups of people of dissimilar age (different types and intensity of music, for example), social status, religion (sounds of Christian church bells or the sounds of Islamic azan, for example). Despite such diversity, it is suggested that there will be more agreement than disagreement between people regarding sounds that can be identified as wanted in many contexts. The task of having to deal with the complexity of different community views is not peculiar to the field of soundscapes.

Until recently, the acoustics community has paid little attention to human appreciation of sound outdoors and its contribution to well-being. There have been eight decades of studies into *what noise annoys you* starting with the New York surveys in the 1920s.³⁴ By comparison there has been relatively limited investigation into *what sounds do you enjoy or what sounds do you prefer*. However, there is now increasing evidence of the types of sounds that people prefer in particular contexts. This includes investigations by Tamura,³⁵ who examined the outside sounds residents preferred to hear indoors, and Carles *et al.*,¹⁹ who found that natural sounds, particularly of water, create positive feelings toward the landscape. There is also increasing investigation into the expectations of people in terms of sounds heard in particular environments, such as in urban parks and streets in Naples,^{36,37} the archaeological site of Pompeii,³⁸ French cities,³⁹ and national parks.^{22,40} The results tend to be consistent and unsurprising.^{5,22,38,39,41} People prefer sounds of moving water in all its forms—that is, the gentle trickle of a stream, the roaring of a mountain river,

Table 3. Differences with respect to level, measurement, and management.³⁰

Environmental Noise Management Approach	Soundscape Approach
Human response related to level of sound	Preference often unrelated to level—quiet not the objective
Measures by integrating across all sound sources	Requires differentiation between sound sources: wanted sound from unwanted sound
Manages by reducing level	Manages by “wanted sounds” masking “unwanted sounds”

the sounds of waves on the beach (whether those be peaceful lapping or violent crashing), the sound of rain, of waterfalls, and of fountains in urban areas. People also prefer the sounds of nature (e.g., those of birds, animals, and to somewhat less extent, insects, and the sound of wind in trees). Finally, people generally prefer the sounds made by other people (voices, footsteps, laughter, singing) over mechanical sounds (e.g., vehicles, machinery, ventilators). The exact nature of the source and context are critical. For example, Nilsson and Berglund⁴¹ found that the mechanical sounds of pleasure and commercial boats were judged as neutral or pleasant in parks and suburban areas in Stockholm, whereas the mechanical sounds of road traffic sources were more likely to be judged as annoying.

6. MEASUREMENT AND MANAGEMENT DIFFERENCES IN SOUNDSCAPES AND ENVIRONMENTAL NOISE

In addition to the different foci of the two approaches described in Table 1, Table 3 summaries critical acoustic differences.

Most measurement and management of environmental noise is highly dependent on physical measurement of level, frequency, and temporal dimensions of the noise signal. Further, many adverse human responses to environmental noise are understood, on good evidence, to be some function of the level (and other dimensions) of exposure to the sound. This does not appear to be the case in the soundscape field, and there is growing understanding that human preference for outdoor sound is unlikely to be primarily determined by physical dimensions of the sound.⁷ Context, the information in the sound, and individual attitudes and expectations all may play an important role in judgments of outdoor sound quality.

There is consistent evidence that human judgment of soundscape is not related to loudness of sound. Brambilla and Maffei³⁶ demonstrated from a laboratory simulation experiment that acceptability of sounds in a countryside context depended on the presence (detectability) of certain types of sounds (e.g., church bells, stream, children’s voices) and less on the level of these sounds. Similarly, Yang and Kang⁴³ showed that in urban open public spaces, self-assessment of acoustic comfort was largely unrelated to the level of the sound being experienced, even over an L_{eq} range of the A-weighted sound-pressure level of 50 to greater than 75. Further, acoustic comfort evaluation was greatly affected by sound source type, with comfort greatest when the source was a fountain in a park. This effect was present at all levels of sound. Others⁴⁴ found that while

loudness and judged unpleasantness/pleasantness of the soundscape were highly correlated within trafficked streets (largely judged as unpleasant environments by their respondents), the two were poorly correlated for the soundscapes of parks, and there was no correlation between them in the soundscapes of marketplaces. The parks and markets were regarded as having relatively pleasant soundscapes. This is experimental evidence that explained variance of hedonic judgments of sound in Paris streets and other locations is increased by including source identification.

The results are similar for outdoor recreationists. Response to sound (on a pleasing-annoying scale) in an outdoor recreation environment was independent of the level of sound over a very wide range of sound exposures.⁴⁵ There is evidence¹⁶ that visitor response had much less to do with loudness or with quietness than it did with whether the sounds present were appropriate to that particular setting. Quiet is not the only characteristic that determines people's preference for outdoor soundscapes.

The energy-integrative approaches to sound measurement that are the norm in environmental noise appear particularly unsuitable in assessing soundscapes. Human assessment of soundscapes depends critically on distinguishing between different sound sources: mechanical sounds from natural sources, human voices and footsteps from the sounds of transport, etc. Integrating sound may be intuitive in noise measurement, but this is counter to the way people experience much of the outdoor acoustic environment. Evidence through psycholinguistic studies¹¹ shows that meanings attributed to sounds act as determinants for sound-quality evaluations. People categorize urban soundscapes by source when specific sound sources can be isolated, and by the presence or absence of human sounds where many sources contribute to the background. The conclusion is that soundscapes need to be conceived and investigated by first identifying relevant semantic features, and only then by correlating them with quantifiable (acoustic) parameters. A similar notion is that areas of high acoustic quality are identified by whether sounds are *wanted* or *unwanted* in particular contexts, not just by the levels of sound.⁴⁶ High quality acoustic environments result where the dominant sounds heard in a place are those that are wanted or preferred in that place, and/or that sounds that are not wanted or preferred in that place are not heard.

Despite the growing evidence that measurements based on level or loudness are unable to account for much of human preference for outdoor soundscapes, the search for physical acoustical correlations continues. Hearing-related physical parameters, other than the averaged intensity of the acoustic stimulus, may be necessary in order to characterize environmental sounds.⁴⁷ Measures such as sharpness, roughness, and fluctuation strength of sound have been suggested,^{48,49} as have acoustic properties of sound events,⁴⁷ and music-likeness,⁵⁰ with emphasis on the spectral and temporal properties of sound—though there is little evidence to date that these help explain human preference in outdoor sound environments.

In summary, these observations demonstrate important divergences between soundscape and noise control in their approaches to measurement and management. In the noise con-

trol field, sounds are measured by integrating them, generally independent of source. In the soundscape approach, the information content of the sound is critical, and identification of sounds of different sources is required. Methods of integration of energy (irrespective of sound source) that we predominantly use in noise control (the L_{eq}) are found wanting as a way to measure sound related to human preference. Further, management of noise is most often achieved by reducing these integrated levels of exposure. Management in soundscape approaches may need to utilize level reduction, but overall objectives are not necessarily lower levels of sound, rather that wanted sounds are not masked by unwanted sounds.

6.1. Masking

Nearly all acoustic environments in outdoor places of interest will consist of sounds from many sources.

Human perception of an outdoor soundscape is likely to be determined, again within any particular context, by the nature and relative intensities of the sounds that are present. Preference (on some human outcome dimensions such as enjoyment, relaxation, excitement, comfort etc.) is likely to depend on whether wanted sounds are heard and unwanted sounds not heard. Soundscapes need to be disaggregated by component sources. In acoustical terms, the phenomenon is masking—wanted sounds not masked by unwanted sounds, or wanted sounds masking unwanted sounds. It is suggested that the concept of masking may prove an important key to soundscape study, analysis, and design, but it has been somewhat neglected to date. Davies et al.⁴² observe “... *soundscape assessment relies upon the identification of the sounds, the prominence of the sounds, and potentially the ratio of certain sound types to other sound types within the soundscape*”.

This principle is already in application in some aspects of management of outdoor soundscapes, though not always specifically recognized as fitting under the umbrella of masking. Variations in application of the principle include:

- The concept of natural quiet (natural sounds not to be masked by human-made sounds);
- Management based on audibility criteria²⁶ (certain sounds required to be inaudible);
- Masking for a minimum period of time (unwanted sounds not to be audible for more than a percentage of time)—a time-above measure; and
- More colourfully—as Westerkamp⁵¹ suggests—“*Walk towards the fountains and continue to listen to the city sounds until they disappear behind the sounds of water.*”

The masking of the sounds of road traffic by the sound from a water structure in a park, and vice versa, have recently been examined.^{52,53}

7. OTHER ISSUES

While there has been quite rapid advancement in our conceptual understanding of people's perception of their acoustic environments, there are still significant gaps. These include:

- Appropriate techniques for the measurement of soundscape perception;
- The ability to simulate soundscape experience through, for example, studies in virtual laboratories;
- The effect on perception of the individual's levels of engagement
 - with the space/activity,
 - with the soundscape of that space/activity;
- Visual/aural interaction;
- The potential restorative value of soundscapes—potentially important in quality of life and human well-being; and
- The role of listening styles
 - analytical listening versus distracted listening, as described by Truax.⁵⁴

Researchers in environmental and community noise are also beginning to investigate the contribution that soundscape approaches can make to an understanding of human responses to noise in both urban and nonurban contexts. This includes the effect of source and context on human experience of noise⁵⁵ and the potential restorative capacities of soundscapes on human health and well-being, including the value of high quality acoustic environments to people otherwise living in noisy urban areas.^{56–58}

8. SOUNDSCAPE PLANNING

Soundscape concepts open up the potential for the same expertise that is brought to the control of the adverse components of the acoustic environment to be applied positively—to the management of those parts of the outdoor acoustic environment that are of high quality and are valued by people—by acoustic design or acoustic management of outdoor space. Kang⁹ suggests that the study of soundscapes is not only the passive understanding of human acoustic preference, but can be “...placed into the intentional design process comparable to landscape...and into the design process of urban public spaces”. Soundscape planning can contribute to the management of not just urban environments, but also rural, recreational, and wilderness environments.^{22,59} Sieben⁶⁰ likewise suggests that soundscape theory offers the possibility to consciously integrate the acoustic environment into the design for interior and exterior spaces. Opportunities are likely to be greatest when areas are being redeveloped, or in initial design stages, and in places such as urban parks and gardens, national parks and wilderness, recreational areas, malls, pedestrian precincts, and historical, cultural, or heritage sites³⁸

or any place where preservation and reinforcement of sound marks¹ is appropriate. The following (Figure (1)) suggests the way that the underlying concepts of soundscapes can be incorporated as steps in a design process.¹⁰

8.1. Steps in a Soundscape Design Process

The design of outdoor acoustic space requires careful specification of acoustic objectives. Step 1 requires unambiguously defining the place of interest and context (e.g., who are the people involved, what are they doing, what are others doing, time of day, weather, motivations, expectations, etc.). In Step 2, the acoustic objectives for this place and this context need to be established (using the normal processes by which planners gain community or focus group consensus). Examples of some possible acoustic objectives (for different places and different contexts—not an exhaustive list), which take into account the soundscape design principles of preference and masking, are:

- Moving water should be the dominant sound heard;
- A particular (iconic) sound should be clearly audible over some area;
- Hear, mostly (non-mechanical, non-amplified) sounds made by people;
- Not be able to hear the sounds of people;
- The sounds of nature should be the dominant sound heard;
- Only the sounds of nature should be heard;
- Suitable to hear unamplified speech (or music);
- Suitable to hear amplified speech (or music);
- Acoustic sculpture/installation sounds should be clearly audible; and
- Sounds conveying a city's vitality should be the dominant sounds heard.

Unlike noise control, where acoustical objectives are usually specified in terms such as: *levels should not be greater than x dB*, the objectives include specification of the wanted sounds in the place (e.g., moving water, nature, speech, music, church bells). The objectives also sometimes include the unwanted sounds (e.g., to not be able to hear the sounds of people) and specification of the extent of masking required—whether masking should be *complete* (the only sound heard) or *partial* (the dominant sound heard). If planners complete Steps 1 to 3, acoustic specialists can be charged with investigating the opportunities for acoustic management and design in Step 4, using all of the skills and tools normally applied in noise management and acoustic design.

9. SUMMARY AND CONCLUSIONS

There has been progress in the development of the soundscape concept as it applies in the management, planning, and design of the acoustic environment—primarily, but not exclusively, of the acoustic environments of outdoor space. This has

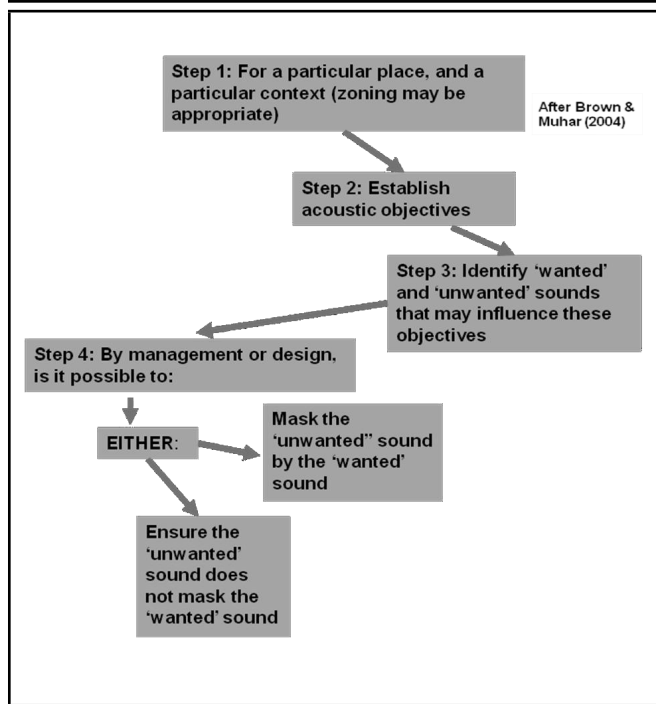


Figure 1. Steps in an acoustic design process for outdoor space.

been, in part, an outcome of the following reasons: the European Environmental Noise Directive, interest in the soundscapes of wilderness areas in the US, and international cooperation through ISO and the European COST *Network on Soundscape of European Cities and Landscapes*. The soundscape is the acoustic environment of a place, as perceived or experienced by people, whose character is the result of the action and interaction of natural and/or human factors. This definition usefully draws on the analogy of soundscape as the auditory equivalent of landscape. While the *soundscape* of a place is thus a perceived entity, soundscape management, soundscape planning, or soundscape design aim at management or manipulation of the acoustic environment of a place to change the way that its acoustic environment is perceived by humans.

Through soundscapes, the outdoor acoustic environment is usefully seen as a resource in which diversity is to be managed and enhanced, complementing the waste-management-control approaches of environmental noise management. Soundscapes also generally focus on human outcomes related to preference or acoustic comfort in distinction to the focus in environmental noise management on adverse human outcomes. There is consistent, but unsurprising, evidence that people prefer the sounds of moving water—in all its forms (e.g., the gentle trickle of a stream, the roaring of a mountain river, the sounds of waves on the beach, the sound of rain, of waterfalls, and of fountains in urban areas). People also prefer the sounds of nature (e.g., birds, animals, and to a somewhat less extent, insects and the sound of wind in trees). Finally, people prefer the sounds made by other people (e.g., voices, footsteps, laughter, singing) over mechanical sounds (e.g., vehicles, machinery, ventilators). However, in contrast to human response to noise, human preference for a soundscape appears not to be a function of the level of the sound. Places where the level of sound is loud may be preferred soundscapes, as are places that are quiet. Instead, preference for a soundscape appears to

depend on congruence between the soundscape of a place and the activities/expectations of the people in that place. Context is critical, and human response to soundscape needs to be understood and studied within person-place-activity models of environmental experience

The energy-integrative approaches to sound measurement that have become the norm in environmental noise management appear particularly unsuitable in assessing soundscapes because human assessment of soundscapes depends critically on distinguishing between different sound sources and whether particular sounds are wanted or unwanted in that context. This is a significant shift for those practiced in environmental noise management in which objective physical measurement of the acoustic environment has been paramount, and objectives generally focussed on reducing the levels of sound immissions.

Soundscape concepts open up the potential for the same expertise that is brought to the control of the adverse components of the acoustic environment to be applied positively—to the management of those parts of the outdoor acoustic environment that are of high quality and are valued by people—by acoustic design or acoustic management of outdoor space. Soundscape planning can contribute to the management of, not just urban environments, but also rural, recreational, and wilderness environments too. Soundscape theory offers the possibility to consciously integrate the acoustic environment into the design and management of such places, and opportunities are likely to be greatest when areas are being redeveloped or in initial design stages. Masking is a key principle of soundscape planning and design.

It is not a matter of choosing either a noise control or a soundscape approach, but rather choosing noise control supplemented by soundscape planning. A potential outcome of adopting soundscape approaches may be that it will assist in capturing the imagination of politicians, policy makers, and a range of design professionals with respect to the management of the outdoor acoustic environment in a way that the current sole focus on environmental noise control tends not to.

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